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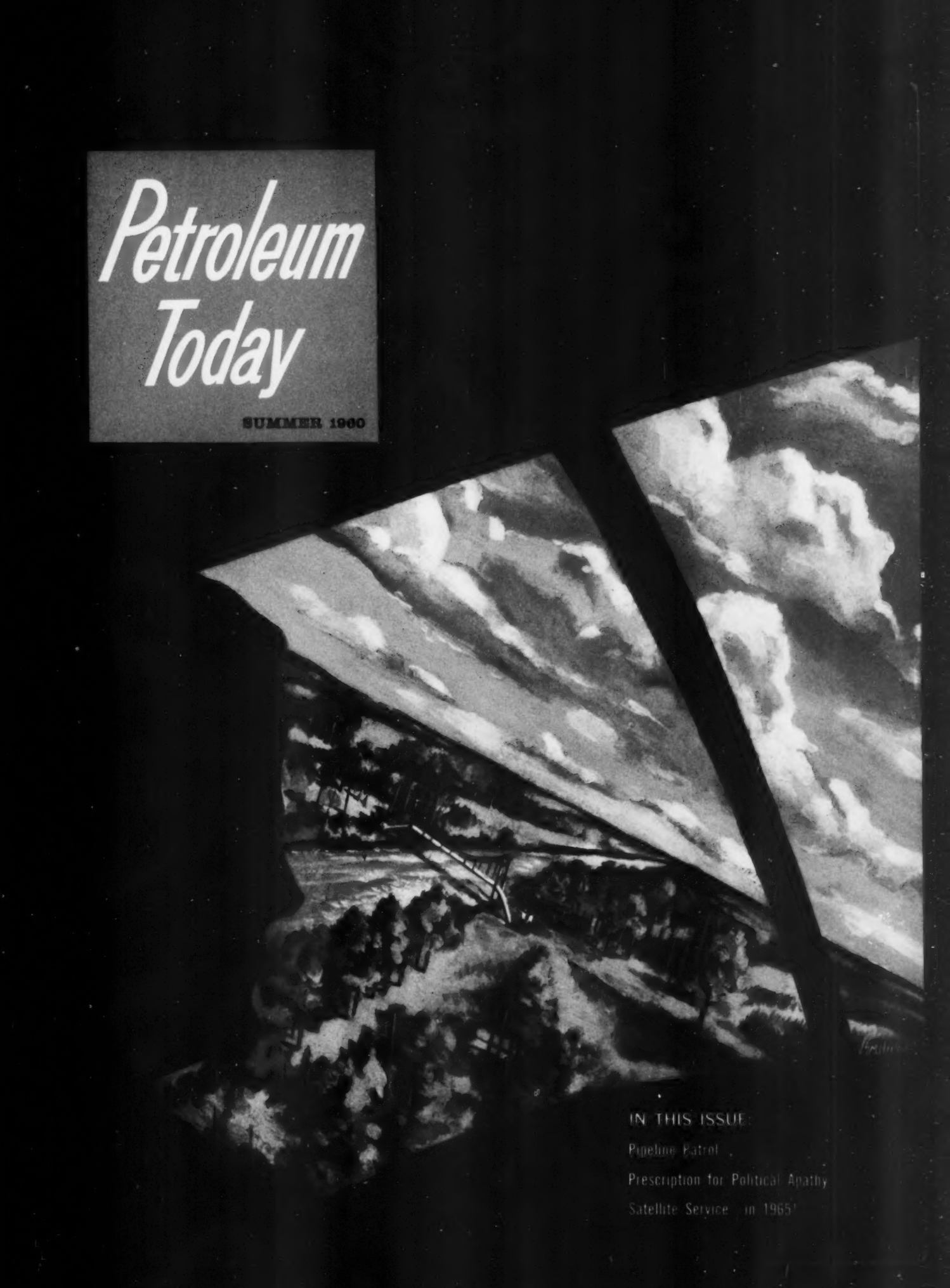

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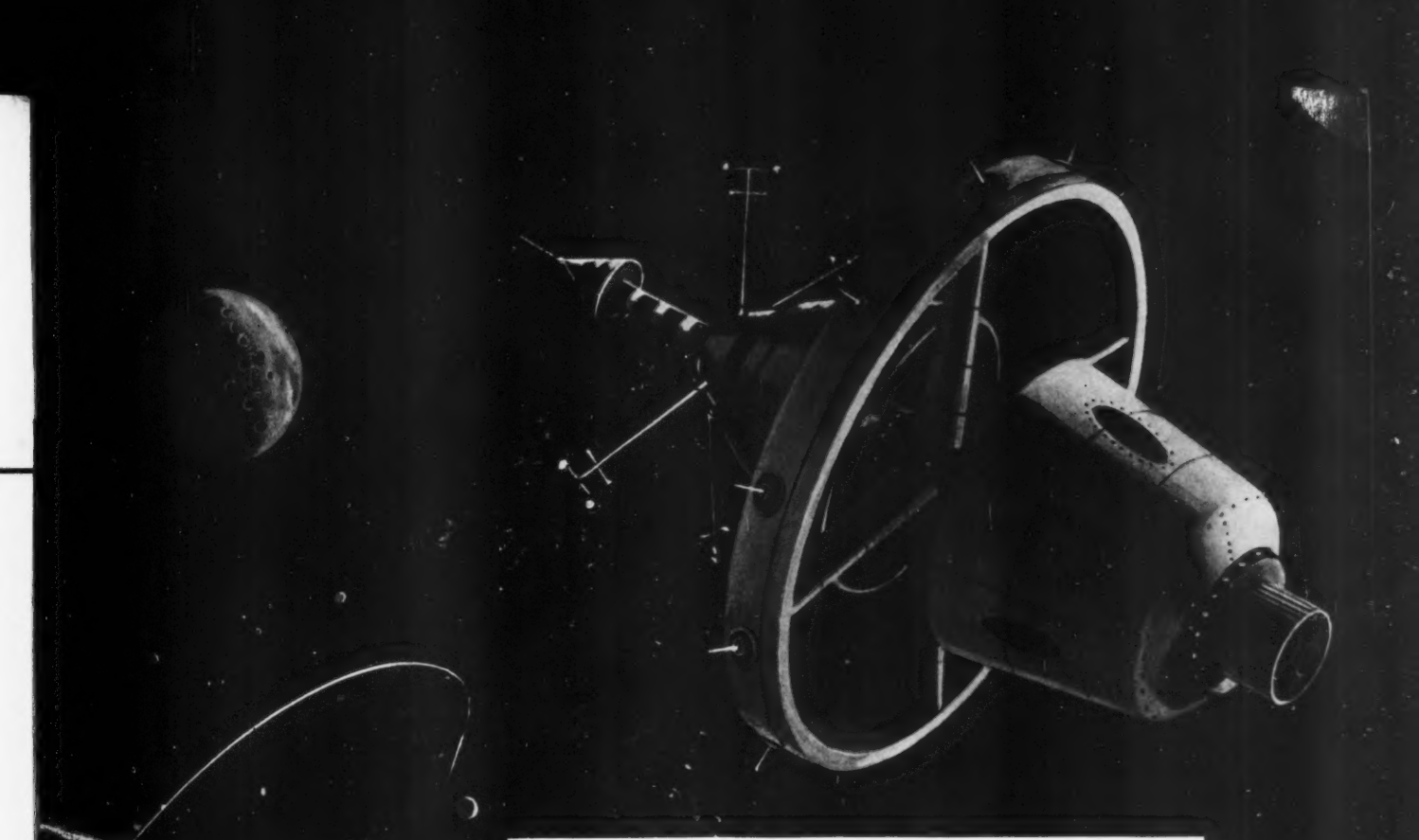
COVER COMMENT

The man at the controls of the aircraft on our cover is a vital link in the maintenance of a vast network of petroleum pipelines. The hazards and rewards of his occupation are detailed starting on page 25.

We can dream of a day when pipeline patrols might operate out of satellites. But meanwhile, for some more immediate and universal benefits from space vehicles, see our lead story across the way.



Satellite Service—in 1965!

by Edwin Diamond
Science Editor, *Newsweek* Magazine

PUSH your mind ahead, just five years. It is a Friday afternoon in July 1965. Bill Simpson and his family are looking forward to a long and happy weekend.

The sales campaign that textile executive Simpson had launched on Wednesday ("launched" was the right Madison Avenue word; he was using the Orbital Post Office System) had been a resounding success. Replies were in already from Australia, Sweden, and India.

So this would be a weekend to celebrate. Before Mrs. Simpson made too many plans, she checked the weather description—not prediction; that had gone out with rock 'n roll. Only a mild shower along the eastern seaboard would cloud the weekend for an hour on Sunday, she found. And

An orbital post office system will be operative by 1965, allowing U. S. businessmen to receive replies to their overseas letters on the same day that they are sent.

there was no question about the conclusions of the reliable electronic eyes of Satellite Weather Central.

Even the prospect of rain wouldn't dampen the fun. On Sunday afternoon the ITS (Intercontinental Television System) would be offering a choice of the Salzburg Music Festival from Austria or the Bantu twilight ritual dances held in connection with the African visit of young Prince Charles of Britain. Both presentations, of course, would be "live," relayed round the world by space satellite.

THE satellite services set forth in this scene do not represent any costly or radical departures in the march of space technology.

The year 1965 is not a capricious choice.

By that time the man in the street will be receiving the immediate and direct benefits of the space age. Indeed, the forerunners of the three systems described above have already been flight tested.

ORBITAL POST OFFICE. Just before Christmas 1958 the United States launched an Atlas ICBM into orbit. A transmitter tucked inside carried a message of peace and good will from President Eisenhower. For Army signalmen, the "Talking Atlas" provided more fun than any electric train for a boy. They made Atlas a space courier, picking up messages over California and rebroadcasting them moments later to stations in Georgia.

Engineers like George Senn, who was in charge of the Atlas radio relay system, foresee a series of orbiting post offices and communications relay stations to speed mail deliveries and improve long-range communication. Present facilities are overtaxed; airlines carry a backbreaking 110,000 pounds of international mail daily; the military vies with private agencies for channel allocations.

But suppose six Talking Atlas satellites were in orbit. According to space wizard Wernher von Braun, they could put all the post offices of the world out of the long-distance and foreign mail business—and would pay for themselves within a few years. A Radio Corporation of America feasibility study shows how: The daily international airmail would be written on V-mail-type paper and then scanned electronically. Combined with modern techniques of high-speed coding, the entire mailing would clear in six hours. An American businessman could get a reply to his letter the same day.

SATELLITE WEATHER CENTRAL. Early in April of this year the United States television camera-carrying satellite, Tiros I, gave man his first panoramic view of the earth's cloud cover—that atmospheric caldron where the world's weather is brewed.

Visible on the first set of pictures released was the northern edge of the cold front that marched across the U. S. that week. There, too, were the spent-out clouds of the storm that had whipped Quebec with its worst freezing rainstorm in 15 years.

"For years, the weatherman has looked at the clouds from below, like an ant," the U. S. Weather Bureau's Harry Wexler said. "Now we have a bird's-eye view."

This bird's-eye view, in the opinion of long-suffering weathermen, who realize their job is still more of an art than a science, is the key to precise weather forecasting and eventual weather control. Despite recent meteorological advances, there are huge gaps in the world's weather networks. The atmosphere above four-fifths of the earth's surface is presently unmonitored—ample room for hurricanes and storms to spawn undetected.

With the experimental Tiros alone, weathermen have witnessed cloud phenomena that have caused them to revise long-held notions of storm formation. When bigger satellites, capable of carrying cameras with longer focal lengths, are sent into orbits from pole to pole, they could effectively cover the whole globe as the earth rotates beneath the satellite path. Wexler estimates it would take six such polar satellites plus one girding the Equator to give complete weather coverage.

With the accurate and advance information provided by such a system, Dr. Francis W. Reichelderfer, chief of the U. S. Weather Bureau, predicts that the U. S. East Coast might never again suffer huge loss of life from surprise hurricanes.

RADIO-TELEVISION RELAYS. "It is safe to predict," says Dr. Louis Dunn, president of Space Technology Laboratories, Inc., Los Angeles, "that this particular use of rocket vehicles will have more direct effect on the man in the street than any other development in space technology."

By 1962 the National Aeronautics and Space Administration, which has been assigned the task of peaceful exploration of space by President Eisenhower, will have rocket boosters powerful enough to lift the first experimental TV relay station into space. At present TV transmission is limited to line-of-sight stations, which means a relay station cannot be over the horizon.

This costly and cumbersome system will become obsolete with just four relay satellites put in "stationary" position some 22,300 miles high ("stationary" because at the precisely calculated altitude, the time the satellite takes to orbit the earth is equal to the time of the earth's own rotation). This new line-of-sight system means that a TV program could be sent between any two points on the earth cheaply and without delay. Perry Como and Wyatt Earp, or the Bolshoi Ballet, could be beamed into every village square—along with their respective sales pitches.

The above are only the most spectacular of the direct, civilian services that can be expected from satellites. The U. S. Transit satellite now orbiting the earth, for example, is a military experiment to develop an "artificial star" system for air and sea navigation. Transit is named after the surveyor's tool; with a quartet of Transits, no ship need fear getting lost when weather closes in (ruling out star fixes) or when too far from land to make use of signals put out by radio-ranging stations. Day sailors and pleasure boaters, as well as Navy submarines, will benefit.

Five years from today satellite television will make it possible to bring the sights and sounds of the world into American living rooms "live" as they take place.

Next on the space agenda are the unmanned exploration of the moon; telescope satellites to give astronomers their first clear, sustained look at the sun and stars; reconnaissance missions to Earth's near neighbors Mars and Venus.

There may be no immediate, tangible return from the exploration of the solar system. But how does one put a price tag on knowledge about the origins of the universe? Or whether there is jellyfishlike life on the planets? Or the eventual destiny of the universe?

Anything we can predict, Dr. Fred L. Whipple of the Smithsonian Astrophysical Laboratory points out, will probably be overshadowed by "unexpected—even unimagined—developments."

OIL IN SPACE

A Soviet scientist recently predicted that the first man to reach the moon would find large quantities of oil and natural gas awaiting him. American scientists discount the theory, but they have long been aware of the fact that there is oil in space.

Oilmen are basically in the business of providing energy—low-cost, abundant energy that has powered the nation to the world's highest standard of living. With the development of the U. S. missile and rocket program, the military looked to the oil industry to continue its role, in a new dimension.

The industry has produced millions of gallons of liquid fuels for missile tests. Petroleum researchers are testing new high-energy solid fuels and high-performance space lubricants as well.

- At an Air Force-owned plant in Florida, crude oil from nearby wells is broken down into hydrogen gas, carbon dioxide, and other products. The hydrogen is refrigerated and purified. It will fuel a rocket space flight.
- In an East Coast oil research laboratory, scientists mix minute chemical quantities under extreme pressure and temperature. They are looking for new compounds, transmuted like the alchemist's base metal from standard known chemicals—new compounds to power solid-fuel missiles.

At other locations across the country, oil industry specialists are taking part in the assault on space. They have the experience, the skill, and the resources to do the job. And, as the accompanying article indicates, they're doing it. **THE EDITOR**

Four Corners

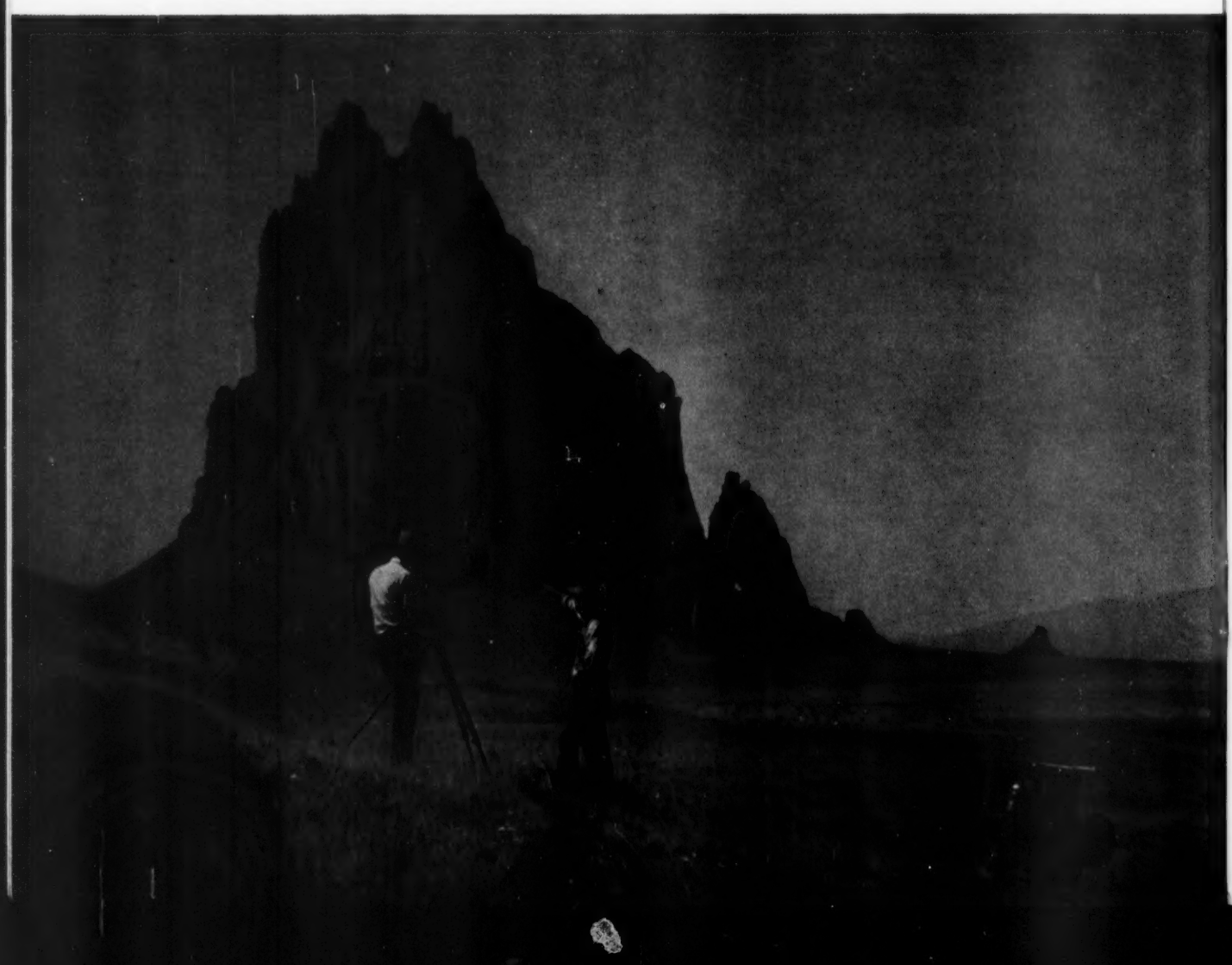
by Wallace West

Towns doubled in size, Indians prospered, and archeologists had a field day when the oil industry brought a new way of life to an American wasteland.

HIGH on the Colorado Plateau, northeast of the Painted Desert and within a 150-mile radius of the Four Corners—where the boundaries of New Mexico, Arizona, Colorado, and Utah meet—lies a "last frontier." In this vast and isolated area, located largely within the boundaries of the Navajo, Hopi, and Ute Indian Reservations, fabulous oil, gas, uranium, and coal strikes of the past 10 years are working exciting changes.

This is a territory of tawny deserts and track-

Mighty Shiprock towers in the distance as petroleum engineers study the stark New Mexico landscape.



less national forests, of fertile canyons with brawling trout streams, of saw-toothed buttes that resemble fairy castles or ships under full sail, and of shining steel well derricks and oil storage tanks.

At present the region's wealth flows from the Aneth oilfields in southeastern Utah, the great San Juan gasfields that lie on both sides of the Colorado-New Mexico border, and the Bisti oilfields just below them. Petroleum geologists are convinced that the future of the Four Corners lies in the largely unexplored Black Mesa Basin covering northeastern sections of the Navajo and Hopi Reservations. Physicists see a great expansion of uranium mining as the atomic age gets under way. And farmers dream of making millions of acres of potentially fertile desert blossom as soon as the Glen Canyon and Navajo Dams begin supplying them with almost limitless water for irrigation.

Until recently a square mile of this desert country did well to support "five Indians, 50 sheep and 5,000 prairie dogs." The only sounds heard there were the ageless whisper of the wind, the creak of an occasional Navajo wagon, or the yapping of the coyotes. Now the buttes resound with the clank of drill rigs, the roar of trucks loaded with pipe, and the muffled dynamite explosions set off underground by geophysicists in their daily search against odds for new oil deposits. And population is skyrocketing — Farmington, New Mexico's "oil metropolis," has grown from 3,600 to more than 30,000 since 1950.

Ten years ago mile-high Farmington was a sleepy village. Its only claim to fame rested on the fact that early settlers had laid its foundation on moldering pit homes of Basketmaker Indians who inhabited Totah, "a green place among waters," some 2,000 years ago.

Farmington lived up to its modern name by growing fine fruits and vegetables on truck farms irrigated by the San Juan, Animas, and La Plata Rivers. It boasted one hotel, a station on a narrow gauge railway, and several trading posts where lovely Navajo blankets and silver *concha* belts could be bought by visitors to nearby cliffhouses. Main Street gossip revolved endlessly around rumors that one or another of the oil companies that were spending millions of dollars annually on exploration work in the vicinity had finally made a strike.

In the summer of 1950, just 43 years after the first show of oil had been found in the Four Corners, not one but several real strikes were made. The calm was shattered.

Caravans of trucks loaded with oilfield and roadbuilding equipment started lumbering into Farmington and its neighbor towns of Cortez and Durango, Colorado. Flatcars of the narrow gauge were too short to carry in the endless lengths of steel drill pipe and casing needed as hundreds of wells were put down; so they were coupled in threes to handle their new job. As early as the fall of 1951 a 24-inch pipeline was rushed to completion in order to transport the tremendous flow of natural gas from the Four Corners area to fuel-hungry California.

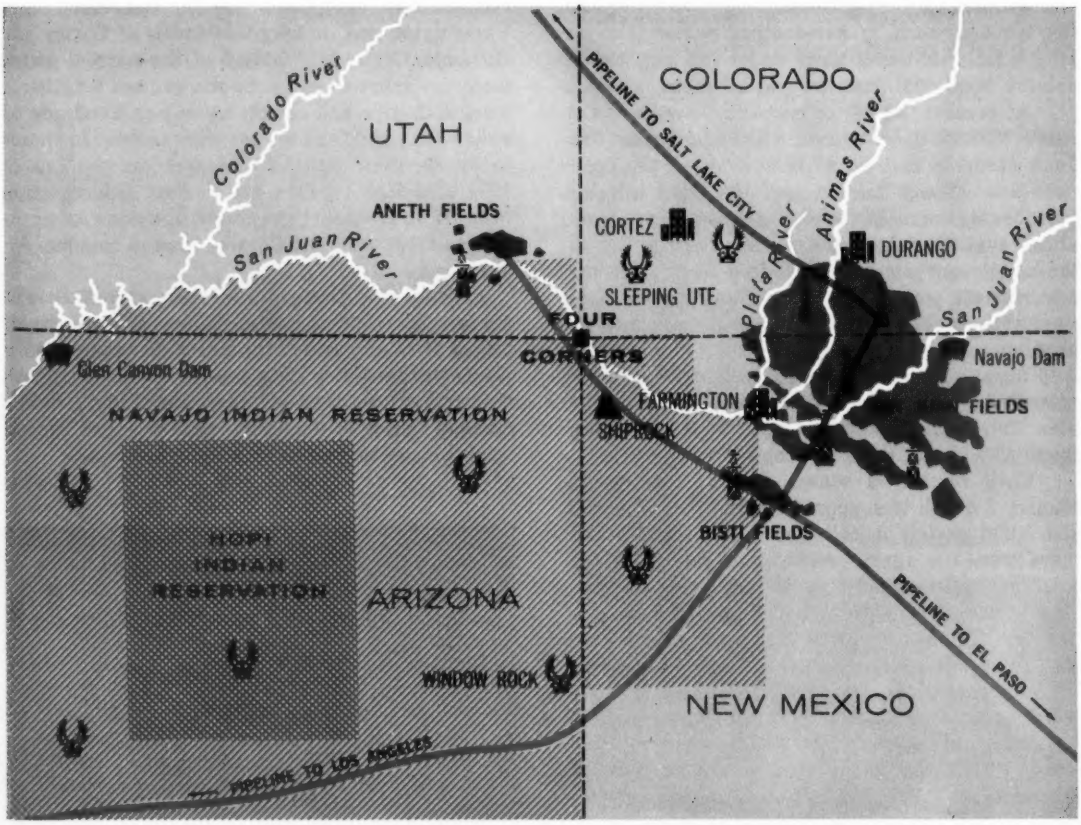
Meanwhile, thousands of drillers, roustabouts, engineers, and other oilmen had poured into Farmington from all parts of the world. Newcomers soon overflowed the hotel. They slept in the 3,000 trailers that rolled into town—if they were lucky; in the railroad station or the park if they were not. Motels were jammed as fast as they could be built.

Farmington, New Mexico, has seen a tenfold population increase since the first major oil strike in 1950.

Farmington's city fathers, accustomed to a $150,000 annual budget, were close to panic at first. They had visions of their peaceful village turning into a Wild West boom-and-bust town. Emergency meetings were called with the Chamber of Commerce, petroleum leaders, the Board of Education, the staff of *The Farmington Daily Times*, and civic, service, and women's clubs of San Juan County.

The area, everyone agreed, must grow according to a carefully developed plan, instead of helter-skelter. And it must diversify its interests and industries so that it would not collapse even if the new petroleum discoveries eventually "played out."

The same policy was adopted by surrounding communities in the four-State region and by the Navajo Tribe. (The Tribal Council suddenly was



being flooded with royalty payments because most of the strikes had been made on its 15-million-acre reservation.)

As a result of determined enforcement of this policy, the whole area is prospering today as it never dreamed possible a decade ago. Examples of this prosperity are endless. Take just two: San Juan County, where 65 percent of the total labor force is directly or indirectly engaged in the oil business, reports family income of about $7,000 a year. Residents speak with pride of a fine new bridge over the turbulent San Juan River and of the great Navajo Dam that, when completed, will impound nearly 2 million acre-feet of water for irrigation and for industrial use.

Farmington itself has become an immaculate community of broad streets and pleasant parks—regional headquarters for dozens of major oil producing companies, 94 oilfield specialty and service firms, and 28 hauling and trucking companies. The trailer population has been cut in half in recent years. Residents point proudly to 6,000 new homes, 93 apartment buildings, 27 motels, 39 churches, and 10 public and three private schools.

The city has a $1.3 million hospital, modern powerplant, fine municipal building, and commodious social, fraternal, and business clubs. It also has its fair share of theaters, bowling alleys, and good restaurants. Municipal improvements for 1959-1960 totaled $6.5 million.

A lot of that money went to modernize the municipal airport, which occupies a broad mesa less than a mile from downtown Farmington and provides Farmingtonians with easy access to the outside world. Fourteen commercial flights to Denver, Albuquerque, Tucson, Phoenix, Salt Lake City, Cheyenne, and other cities make stopovers at Farmington. The port is also used by dozens of

small planes that shuttle oilmen to and from "the regions."

Private and company planes are simple necessities in the Four Corners because of the great distances involved and because many roads, particularly those in the Aneth fields, are passable by only the most rugged of vehicles. These roads, built by oil companies at the cost of about $200,000 a mile to move heavy equipment in and out, are full of chuckholes, subject to flash floods, and are death on mufflers, shock absorbers, and rear axles. Navajo "shade tree mechanics," presiding over piles of spare parts collected near their hogans, keep the heavy supply trucks rolling. But drill crews, geologists, petroleum engineers, and company officials much prefer to do their commuting by air.

JOE DOZIER, assistant to an oil company district superintendent, makes his daily swing out of Farmington in a sweet-running four-seater operated by a skilled desert pilot.

As the green fields around Farmington give way to naked desert, a hitchhiking reporter marvels that anybody can be induced to work in that broiling sun where only sagebrush and cactus grow.

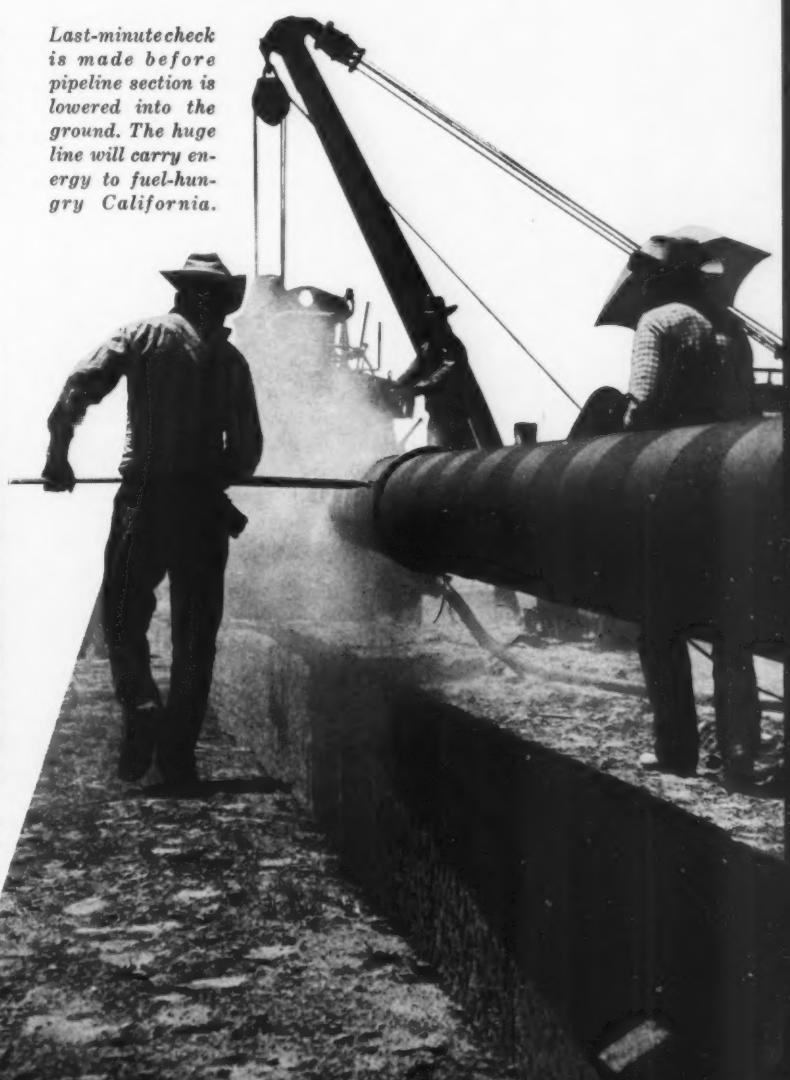
"Men come out here from all over because we pay good wages and give plenty of time off," Dozier replies. "A driller makes around $3 an hour, eats well, and has air-conditioned sleeping quarters. Sometimes he may have to work 12 hours straight, but then we fly him back to town for a 24-hour rest. Few drillers ever go into other lines of work."

The reporter wants to know if "all that Godforsaken country down there" is under lease to oil companies.

"By no means. We've only scratched the surface." Dozier begins reeling off figures. The companies operating in the Four Corners have leases on only 2 million acres of Navajo land—about one-eighth of the reservation. Even so, the San Juan County, *Utah*, region produced almost 95,000 barrels of petroleum daily last year, up 38,000 barrels a day over the previous year. The value of oil and gas produced in northwestern New Mexico rose from about $2 million in 1950 to nearly $59 million

Bernardine Whitegoat is an employee of the Navajo Tribal Council. He stands near one of the oil rigs that are transforming his people's way of life.

Last-minute check is made before pipeline section is lowered into the ground. The huge line will carry energy to fuel-hungry California.



in 1959; in San Juan County, *New Mexico,* oil production alone jumped from around 22,000 barrels per day in 1958 to more than 33,000 barrels per day in 1959.

Very few wells have been drilled yet in Arizona, where the major portion of the Navajo Reservation lies. Some geologists believe that this region contains reserves that may dwarf those already located in Utah and New Mexico.

Below, the miles speed by. Dozier points toward a mountain to the northeast. "Looks like a giant lying on his back," says the reporter.

"That's Sleeping Ute," Dozier replies. "The Indians say he'll wake up some day, unite all the tribes, and make us palefaces take a back seat. Could be! The Ute reservations up that way have plenty of oil."

Those few hundred Utes who live in southwestern Colorado take their royalties on a per capita basis, and most of the money goes to improve their farms. The Navajos, on the other hand, administer their income through their Tribal Council with the help of the U.S. Bureau of Indian Affairs. The funds are being spent on new housing, education, tourist facilities, a system of water wells, and other improvements. As Dozier puts it, "The whole tribe is lifting itself by its bootstraps."

The Navajos have great pride in the past as well as the present, and this pride has been reinforced by archeological discoveries made during pipeline construction in the Four Corners area. Archeologists first study the route the line will take, then follow on the heels of the ditchdiggers. They have found the remains of Indian cultures dating from about 900 A.D., including so-called pit houses that have caused a re-examination of long-held theories about the Navajos. The cost of the archeological work is usually borne by the pipeline company, which also takes the risk that the professors will delay the operation. Dozier insists that such delays are unknown. The reason: a new discipline, nicknamed "pipeline archeology," has been developed, and it is a far cry from the slow and meticulous archeological tradition.

Now the plane is dipping low over a series of roads, straight as strings across the desert. "They're built that way by oil companies that lease Indian land in mile-square parcels," Dozier comments. "They drill one well in the center of each 80 acres. Uniform spacing like that costs money, but it lets us get the most possible oil from under each lease."

The plane dives at a black mark on the desert, a landing strip that seems little more than a foot wide and a yard long. It comes down beside a complex of storage tanks and equipment, duplicates of which are spaced throughout the area. These are lease automatic custody transfer units—LACT's, for short. Each unit costs around half a million dollars and each controls the output from as many as 12 wells.

"These units automatically collect oil and gas from wells that may be several miles apart," Dozier says. "They remove water and impurities, separate the oil and gas, and feed them into those small gathering pipelines you can see snaking across the desert. When the products get to Farmington, they are loaded into one or another of the three pipelines that now connect the Four Corners with California, Texas, and the Northwest."

"Doesn't automation throw people out of work?" asks the reporter.

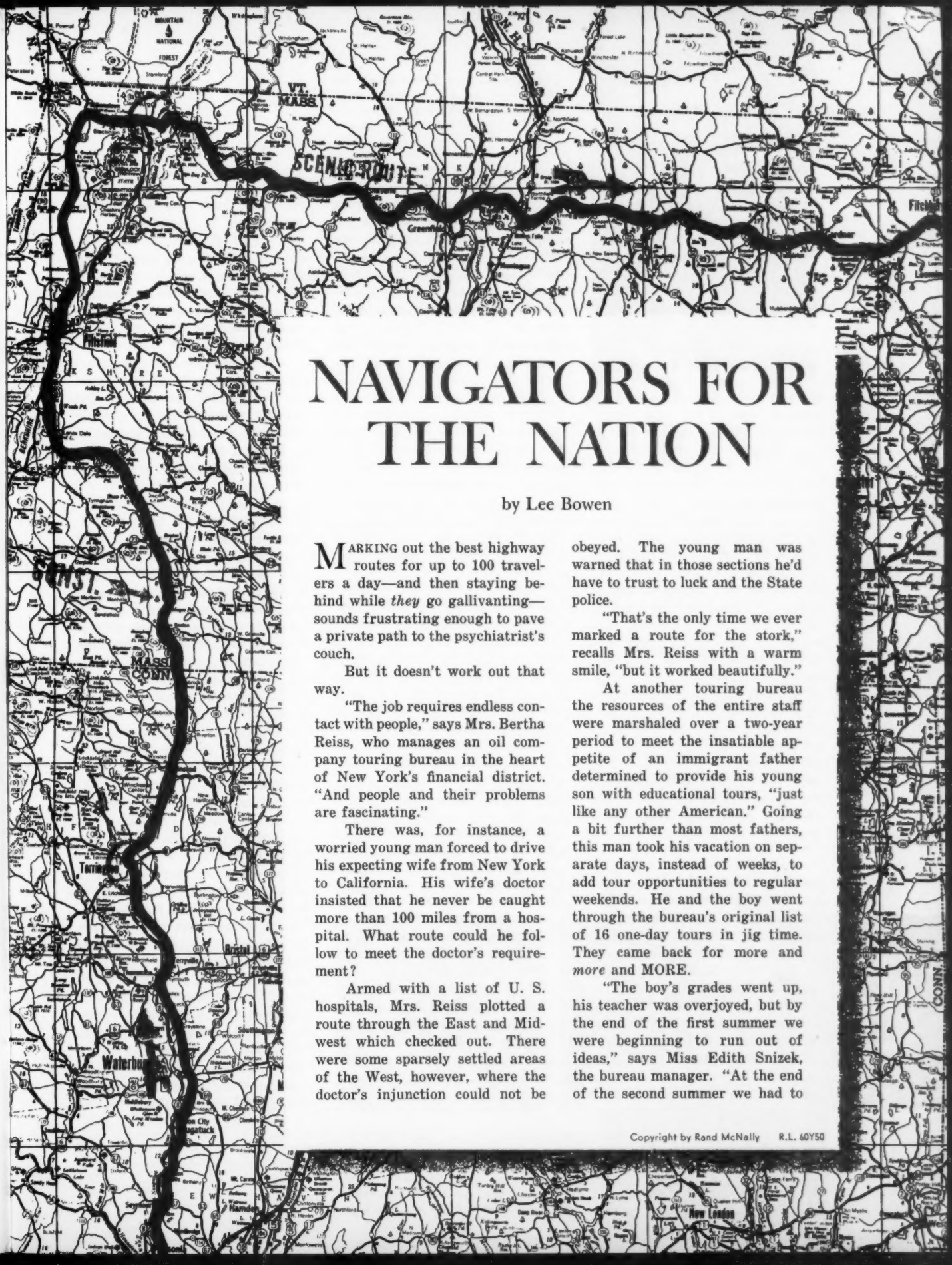
"No; in fact the Four Corners is growing so fast we're always shorthanded," says Dozier. "Automation out here just relieves men for more interesting and creative jobs. And that goes for the Utes and Navajos too. You know, we have a great many Indians working for us now, and the day may come when most oil employees hereabouts will be Indians."

The reporter helps the pilot and Dozier swing the plane around on its narrow runway. And they take off in a shower of mud, result of one of the flash floods that plague the Four Corners.

The sun is close to setting by this time and miles-long shadows of Shiprock, Chimney Rock, and other massive buttes make the desert unforgettably beautiful. The plane detours briefly over the Goosenecks of the San Juan, a majestic many-colored canyon that traces a series of figure-eight loops as the river winds down to join the Colorado. It dips over the stone that marks the precise point at which the four States converge. Then it leaves the twinkling oilfield checkerboard behind and heads for Farmington.

From all directions other little planes, their lights blinking, are coming home like pigeons to their roost. Two DC-3's and three Convairs of Frontier Airlines sit patiently on the runways, waiting for the private planes to land before they get their takeoff signals from the control tower. Soon more than 20 oilmen gather in the airport restaurant, exchanging news of the day and relaxing for a few minutes before going to their dinners.

Half an hour later, when the lights of Farmington start winking on below the mesa, the airport is dark and deserted. Another day has ended on America's newest frontier.



NAVIGATORS FOR THE NATION

by Lee Bowen

MARKING out the best highway routes for up to 100 travelers a day—and then staying behind while *they* go gallivanting—sounds frustrating enough to pave a private path to the psychiatrist's couch.

But it doesn't work out that way.

"The job requires endless contact with people," says Mrs. Bertha Reiss, who manages an oil company touring bureau in the heart of New York's financial district. "And people and their problems are fascinating."

There was, for instance, a worried young man forced to drive his expecting wife from New York to California. His wife's doctor insisted that he never be caught more than 100 miles from a hospital. What route could he follow to meet the doctor's requirement?

Armed with a list of U. S. hospitals, Mrs. Reiss plotted a route through the East and Midwest which checked out. There were some sparsely settled areas of the West, however, where the doctor's injunction could not be obeyed. The young man was warned that in those sections he'd have to trust to luck and the State police.

"That's the only time we ever marked a route for the stork," recalls Mrs. Reiss with a warm smile, "but it worked beautifully."

At another touring bureau the resources of the entire staff were marshaled over a two-year period to meet the insatiable appetite of an immigrant father determined to provide his young son with educational tours, "just like any other American." Going a bit further than most fathers, this man took his vacation on separate days, instead of weeks, to add tour opportunities to regular weekends. He and the boy went through the bureau's original list of 16 one-day tours in jig time. They came back for more and *more* and MORE.

"The boy's grades went up, his teacher was overjoyed, but by the end of the first summer we were beginning to run out of ideas," says Miss Edith Snizek, the bureau manager. "At the end of the second summer we had to

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The lady has a problem: What's the best route to her vacation spot? Maybe the oil company touring center can help. It's worth a try . . .

suggest that if the man wanted more things for his boy to see, he'd have to move to some other town—he'd already been everywhere in New York, New Jersey, and Connecticut."

Contact with people and with real problems like these gives touring bureau employees a feeling of personal satisfaction, a gratifying awareness that they are helping others. This satisfaction not only keeps them off the psychiatrist's couch, it apparently maintains their interest in their jobs. At one of the major touring centers the newest full-time employee has been on the staff for five years.

And the work frequently offers comic relief. Perhaps because of too much TV, many people still must be reassured that bandits are not bushwhacking travelers in the Western desert. Others have a dread of mountains and want a route that will keep them constantly on the inside lane of a mountain road—not the one close to the edge. When Hawaii was admitted to the Union last year, there were several requests for "directions on driving to our 50th State."

Oil company touring specialists at New York, Houston, New Orleans, Shreveport, Chicago, Los Angeles, Tulsa, Washington, Louisville, and other large U. S. cities—plus Toronto, Paris, and Brussels—handle both the serious and the ridiculous on an impressive scale. Almost all of these bureaus provide a mail service whereby a customer gets a routing and free maps by return mail on receipt of the post card request form he picked up at a company service station. Including these mail inquiries, which outnumber telephone and walk-in requests, one of the companies with a half-dozen bureaus says it handles well over a million questions a year. A volume of 150,000 to 175,000 yearly is not uncommon in a single bureau. In one mailroom during the busy midsummer season, the number of requests has hit 3,000 in a single day.

Most touring center employees planning these trips started out with no more knowledge of a road map than the customers they're now helping. Apprentice routers learn their trade in company training programs, usually involving about three months of preliminary work.

"We begin with a very thorough study of geography," says Miss Snizek, who's been dealing with maps for 25 years, "because some trainees come to us with outlandish ideas of what the United States looks like.

"We correct the misconceptions with a big relief map showing topography, and then we get specific about the location of every State, State capitals, important rivers and lakes—the geography lessons that have disappeared from the schools.

"After that, we move into the highway system. It looks complicated to many laymen, but with practice you soon can recognize the major road arteries between regions. Direct routing actually involves nothing more than getting the customer onto one of these major arteries and then off again near his destination."

A candidate begins marking maps after about six to eight weeks of training, starting on mail requests for direct routes, then adding returns, and finally handling scenics—the routes that take in points of interest. The route-line, familiar by now to every motorist, is made in washable ink with a broad felt-tipped pen. (Incidentally, after a trip it can readily be removed with a soft cloth dipped in a solution of water and household bleach.)

A router starts every workday by checking a master map or a list showing highway conditions throughout the country. The major tour bureaus keep tabs on construction-caused detours by means of reports from State highway departments and, in some cases, their own touring cars. One of the most conscientious States is Wisconsin, whose highway depart-

. . . At the desk she puts her problem in the hands of an expert. They go into deep consultation. He suggests a route tailored to her tastes and easy to follow with the help of specially marked road maps. It looks promising . . .

ment sends out a four-foot-wide map each week during the summer to show all highway work under way.

After a year of seasoning in the mailroom, a candidate is ready for counter work. By then he's expected to be able to come up with facts on everything from where cowboys can be seen at work to the afternoon ferry schedule between Bar Harbor, Maine, and Yarmouth, Nova Scotia.

The maps the touring centers work with come from three suppliers. Each has its own style but all compress a spectacular amount of information into a square inch of map surface. Together, the three mapmakers produce from 150 to 200 million road maps a year and bill the oil companies for something in the neighborhood of $14 million.

When the first free oil company road map appeared in 1913, Americans were just beginning to take to the highways in numbers. Drivers depended upon word-of-mouth directions of the "you can't miss it" variety—or on a few printed guidebooks, some of them quite expensive, most of them quite confusing. The maps were an instant hit, and shortly they covered the country. They have been serving as a sort of catalyst between driver and open road ever since.

A new edition of every road map comes out once a year, bringing road construction data up to date. Sometimes as many as 1,000 changes are made in a single new edition—showing a new tourist attraction, upgrading the population symbol on a town, indicating a new campsite.

Touring centers do a lot more than simply single out a road on one of these maps for the traveler to follow. For many people, they actually plan a vacation. The customer describes his family and its interests and tells the touring center how much time he has available. They suggest a region his family will enjoy, mark the national parks or industrial centers or historical sites with appeal for his family group, and provide him with the means of finding out where to stay and where to eat. With maps and pamphlets on the region he's headed for, he may leave a touring center with a package of tailored information weighing up to two pounds.

This expert, personalized travel service is provided free. The company stands to benefit directly only if the driver uses its brand, but often the route passes through areas where the company's gasoline isn't sold. In any event, the company dividend is of the indirect variety: service to the motoring public in general.

Although the trend is to include more and more "point of interest" information on oil company road maps, you can't learn to plan vacations simply by looking at maps. The big touring centers go to great lengths in encouraging travel among their employees. At one of them the company will furnish a car and the gasoline for any weekend trip from New York. Most send representatives on the trips some States stage for travel editors and travel bureau personnel. They are liberal with vacation time when the employee plans a trip on which he can learn something, and sometimes they will pick up the gasoline bill.

Handling a hundred or so requests for information a day, tour specialists get to know Americans pretty well. Some of the developments they have noticed are encouraging.

"Parents are becoming intensely interested in planning vacations to broaden the education of their children," says Miss Snizek. "Many will tell you what the child is studying and ask for a trip that will provide some background. We are planning more and more industrial tours: into the steel-producing areas, the textile region, the winemaking section of New York State.

"And tourists are growing up here at home. A decade or so ago most people traveled through the U. S. just the way the average tourist now does Europe—whipping through a dozen countries in a two-week tour. People are now aware you can't know a State without stopping in it for a while. In another few years they'll make the same discovery about European countries."

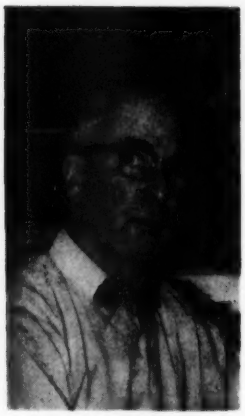
Touring centers have noted a recent booming interest in camping. They believe that in addition to its natural appeal, the big motivation is economy. Lodging and three restaurant meals a day can exhaust the family vacation budget in a hurry.

Despite this trend toward economy, oil companies are confident few vacationers will adopt the gas-saving means of transport planned by a young lady from Palmyra, New York. She wrote that she intended to go from her home to Tampa, Florida, and noted she would be traveling on horseback.

She got a route.

. . . The lady exits grinning, her problem solved. The collection of maps and brochures she has gathered will add much to her travel fun.

TERESA CHIN



ALFRED W. FISHER

PHILIP BERG

AL FISHER'S FUND

Philip Berg was born in Nairobi, Kenya, where his parents had fled to escape Nazi persecution. Teresa Chin was born in Novosibirsk, Siberia, where her father was a member of the Kuomintang Chinese Legation.

These two youngsters, drawn from the opposite ends of the earth, stood together on the platform of the red-brick high school in Vineland, New Jersey, a year ago to receive their diplomas. Several months later they entered college as the first to benefit from the unique Alfred W. Fisher Scholarship Fund.

Al Fisher established the fund as "one man's" contribution to the nation's future.

"We have to compete with the forces of communism not just with weapons but in scientific research and education," he says. "A lot of the big outfits like the oil companies are setting up scholarships to help the country develop leaders. I figured I should do what I could."

What Fisher did was to establish a grant of $100,000, the income from which will send two gifted and needy Vineland High graduates to a higher education each year. He knows the value of schooling, because he had to work so hard to get his own.

At the age of 13 he became an apprentice glass blower in a Vineland factory. He earned a high school diploma at a private school, performing janitorial duties to pay his tuition. He received a degree in chemistry from Temple University, after years of part-time work and night-time study.

Al Fisher places a high premium on education. And he's a firm believer in "get-up-and-go."

In 1926 he bought a panel truck, filled it with cans of motor oil, and went driving about Vineland as a salesman. Before the first summer was over, he owned a tank truck. Before the first year was out, he was constructing a 20,000-barrel oil terminal.

Today he owns a terminal three times that size, four tank trucks, two service stations. He is a distributor of gasoline and motor and home-heating oil for a major petroleum company. He has interests in real estate and the stock market.

Fisher has worked hard for his business success, and he continues to put in a full day at the little office he has filled with antiques and presidential photographs (he himself looks a little like Harry Truman). He is also very busy planning for the future.

He's seeking two patents, for replaceable heels and for a talking gasoline pump. He's "dreaming" of a supervised recreation ground in Vineland as a means of preventing juvenile delinquency. And even further ahead, he has announced that the bulk of his estate will go toward the college scholarship fund.

That way, the Philip Bergs and Teresa Chins of the future will get a helping hand. "They deserve it," says Al Fisher.

Ocean-going Ugly Ducklings

Oilmen hope to reduce offshore losses and explore promising deep-water acreage with these ingenious drilling ships.

by Willmon White

A CENTURY ago and more, men roamed the oceans of the world in search of whale oil to light lamps and lubricate the wheels of industrial progress. Now oil hunters once again are going down to the sea in ships—not in three-masted square-riggers, but in drilling ships topped by oil derricks.

As sailing vessels go, this latest addition to the oilman's seabag is an ugly duckling—blocky as a battleship, bustling with cranes, loud with the clank and roar of giant machinery. But for all its lack of beauty, the drilling ship has great attraction for oilmen: first, because it brings within reach of his drill bit millions of promising deep-water acres out of range of the well-known offshore platform wells; second, because it may mean that many salt-water provinces can be explored, developed, and produced more cheaply than in the past.

The oilman has a warm welcome ready for anything that can reduce the economic gamble in submerged lands, especially in the Gulf of Mexico. Contrary to popular notion, this "blue-chip" operation is deep in the red.

In 15 years oil companies have poured more than $3 billion into the steamy Gulf. Oil and gas produced thus far have been worth only $725 million. Current annual income is $200 million a year, but current annual reinvestment in the Gulf is $250 million.

Perhaps the free-floating drill ship can improve these shaky economics. True, it is still in its infant stage of development. The number of vessels sailing under the industry flag—eight or 10 true drilling ships and a few more smaller coring craft—hardly constitutes an armada. But many industry leaders believe this new concept is destined to exert a profound influence on the future of offshore operations.

The earliest use of a drilling ship in the oil search came at about the end of World War II when small contract boats brought up shallow cores of undersea strata from the Pacific. First experiments of any magnitude, however, were in 1953 by the *M. V. Submarex*, an ex-Navy patrol craft fitted with a small over-the-side drilling rig. Work by this vessel off the rugged coast of California paved the way for deep-water drilling by larger ships. Beginning in 1956, coring successes were chalked up by the *Rincon*, the *Western Explorer*, the *SM-I*, and the *CUSS I*—converted naval landing ships of about 200-foot length that drill through the keel.

Modern drilling ships fall into two general categories: (1) the over-the-side rig that permits well completion above water level and (2) the cen-

Heavy ballast opposite the rig balances the lop-sided-looking vessel. Anchor chains keep it steady.

tership rig that utilizes a revolutionary undersea completion technique. Both have to be towed to the drilling site.

Typical of the over-the-side type is the *Nola I*, the first full-floating drill ship to look for oil in the Gulf of Mexico, in early 1959. This 260-foot drilling tender perches its 140-foot derrick out over the starboard side of the main deck. A large ballast on the opposite side counterbalances the immense weight.

Nola I enables offshore operators to complete wells with conventional, above-water methods. To avoid a platform, which in the Gulf can easily cost several million dollars, marine engineers dreamed up a fairly inexpensive tripod to stand on the ocean floor. Drilling is carried out through a vertical leg of the structure. The vessel's only other attachment with the bottom is by anchor chains that fan out from the bow and stern.

Owners of the *Nola* claim it can drill to 15,000 feet in 200 feet of water with unprecedented economy. It can be moved rapidly from one location to another, they add. And on one occasion it weathered heavy seas, took a five-degree roll, and kept right on "making hole."

Another type of drilling ship—one that may also be able to work at great ocean depths—is the *CUSS I*. This 260-foot craft, too, is highly portable and able to perform common drilling functions even in exposed, rough water. It claims the provocative ability to drill 12,000-foot exploratory holes in submerged lands at costs comparable to dryland costs. Unlike the *Nola*'s, the *CUSS I*'s rotary rig stands over a yawning, diamond-shaped well amidships.

One unique feature of the *CUSS I* is an automatic mechanism for handling the long strings of drill pipe as they are put down or removed from the well. The operation is supervised by a man at a console on the floor of the rig. Without this device, he would have to be stationed atop the 98-foot-high derrick, a precarious post in a rough sea.

Once the center-rig ship arrives on location and deck hands anchor it to huge mooring buoys, drilling proceeds something like this: First, the crew suspends a prefabricated landing base in the center well beneath the hull. Next, the men lower drilling pipe through the base to the ocean floor where drilling begins. To keep the drill bit on the bottom of the well, telescoping joints of pipe and a rocking apparatus on the rotary table compensate for the ship's heave, roll, and pitch.

Finally, drillers guide the base down the drill pipe—much as a seamstress slides a button down a taut thread into position on a garment—and cement it at the top of the underwater hole. During drilling, the base supports the blowout preventer, remotely controlled from the ship by long hoses. Later, it can house the wellhead assembly below turbulent wave action. Equipment on the ocean floor can be checked by a frogman or by closed circuit underwater television.

Crew accommodations on drilling ships are comfortable but naturally more Spartan than the nonfloating offshore "hotels." The galley often serves as TV den, game room, movie theater, library, and first aid station.

Simple diversions while away the off-duty hours. Anything from listening in on the ship-to-shore radiotelephone ("the world's largest party line") to befriending sparrows that are blown out to sea and too terrified to try the return flight. Fishing is fairly popular. They tell of one crewman who hooked a 600-pound jewfish that had to be hauled topside by ship's crane.

Drilling ships aren't self-propelled, but maritime authorities often require that a captain and two able-bodied seamen be aboard. And it's often difficult to separate the oil worker from the sailor.

Drilling vessel with rig amidships features a "birdcage" foundation for equipment on ocean floor. Well is actually completed under water.

OPERATION MOHOLE

THE drilling ship will face its most severe test during Operation Mohole, a pioneering scientific project aimed at answering an age-old question: What is the earth's crust made of and what lies beneath it?

As currently planned, the program calls for man's deepest descent toward the center of the earth with the drilling of a three-mile hole below 14,000 feet of ocean water. Rock cores brought up are expected to shed new light on how and when the world was formed.

Specific target of the drilling will be the Mohorovicic Discontinuity, a geologic boundary thought to exist between the earth's outer shell and the mantle covering its hot inner core. The earth's shell is thinnest under the ocean—thus, the drilling ship.

The challenge of developing equipment and techniques to undertake Operation Mohole has been taken up by oilmen working in close cooperation with groups of the National Academy of Sciences and the National Research Council. Modification of a drilling ship will be one of the first steps. Test drilling is expected to start in 1961.

Working vocabularies are a colorful mixture of seafaring terms (windjammer, cathead, crow's-nest) and oilfield expressions (monkey board, mousetrap, spider).

And the oilmen aboard drilling ships have learned to scan the skies for weather signs just like their sailor comrades. Hunting oil at sea is by nature treacherous. In the Gulf Coast area, sandy silt bottoms have capsized several mobile platforms. Formation pressures are dangerously high. And the biggest threat of all is from hurricanes with 125-mile-per-hour winds, 20-foot waves, and swift currents.

Take the *Nola II*—and you can have her for practically nothing. This drilling vessel, a sister ship of *Nola I*, was headed for a project off the coast of lower Mexico last November. Suddenly, a violent storm swept the million-dollar ship aground near Coatzocoalcas. No lives were lost, but the *Nola II* will probably never float again. There she sits on a forlorn beach where Mexican cows gawk, chew their cuds and, perhaps, contemplate the folly of man.

What the drilling ship of the future will look like is anybody's guess, but one proposed design has neither left nor right. Called a "floating doughnut," it is fantastic enough to be the doodle of an aero-space engineer. Another idea, the "Seven Seas Rig," is buoyed by elephantine pontoons that float below the waves. Also under consideration is a submarine that balances itself on one end and drills through its nose.

Oil company engineers already have experimented with caisson chambers from which they can pump sea water. Perfection of this method would permit a crew to descend to the ocean floor and install equipment while a drilling vessel stands by hundreds of feet above. As for drilling, tomorrow's drill ship may have no derrick at all, but bore with a turbo or sonic drill simply reeled out at the end of a hose.

The drilling ship's ultimate place in the oil business depends on its ability to overcome many economic and oceanographic obstacles. Before the offshore quest can be extended into deeper waters, the industry must see an opportunity to realize a reasonable profit on its investment. This means the drilling ship must demonstrate beyond all doubt that it can save money in submerged lands, where near-prohibitive drilling and equipment costs continue to mount.

Drilling ships are now seeking to prove themselves in various parts of the world, from offshore California to the coast of Peru. And if determination is any criterion, their success is assured.

Captain Ahab, the classic oil hunter of American fiction, vowed ". . . I'll chase him round Good Hope, and round the Horn, and round the Norway Maelstrom, and round perdition's flames before I give him up."

That persistence is but another parallel between the modern oilmen who go down to the sea in ships and their whaler predecessors.

Artist's conception of an underwater oilfield of the future includes gathering lines and modernistic equipment. Drilling ships may make such operations feasible.

Machine-Age

TIMMY'S WORLD: *A pensive future dairyman surveys his family's Ohio farm. His great-grandfather, who started the tradition, would not recognize today's machine-age operation.*

Text and Photos by George Laycock

THREE generations of Van Gordons have devoted their lives to developing the family dairy farm near Hamilton, Ohio. A fourth generation is already learning the ways of dairying; Morris Van Gordon can think of no more rewarding career for his three boys.

"It's very different from what it used to be," he says, "but it's still a big challenge."

When Morris Van Gordon was growing up, he milked cows by hand and learned to heft 80-pound cans of milk. Machines have taken over these chores; but the dairyman's basic skill, his ability to understand and care for his animals, is not susceptible of automation.

SPECIAL EVENT *for Timmy, 2, and Martin, 8, is bucket-feeding of calf. Morris Van Gordon supervises with a grin and a firm hand. He plans to build herd from present 39 to 50, maintain average yield per cow of 10,000 pounds of milk a year.*

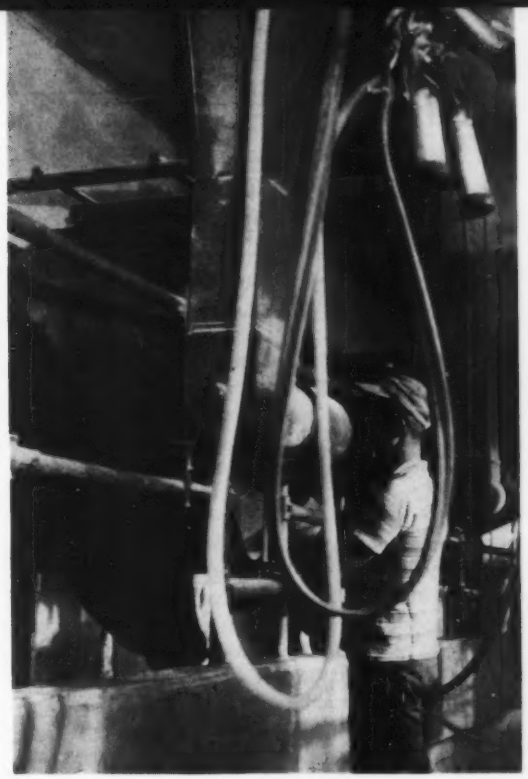
Dairyman

"You have to be easygoing with your cows and enjoy working with them. They can sense if you're nervous, and they won't produce as well." And he adds: "If you get kicked, you can't kick a cow back."

Timmy, Roger, and Martin Van Gordon are absorbing their father's patience and studying the ways of a petroleum-powered, machine-age dairy that produces cleaner, better tasting milk—and more of it—than ever before.

Milking 39 cows takes two hours twice a day with the help of vacuum milkers. From this point onward, the milk follows a course similar to that of many chemical and oil products: through a pipeline to a bulk storage tank to a tank truck to market, with frequent tests for quality and purity.

Modern dairying is a complex business, but the cow has taken the changes in stride. We've found no substitute for her nor for dairymen who, like Morris Van Gordon, understand her.

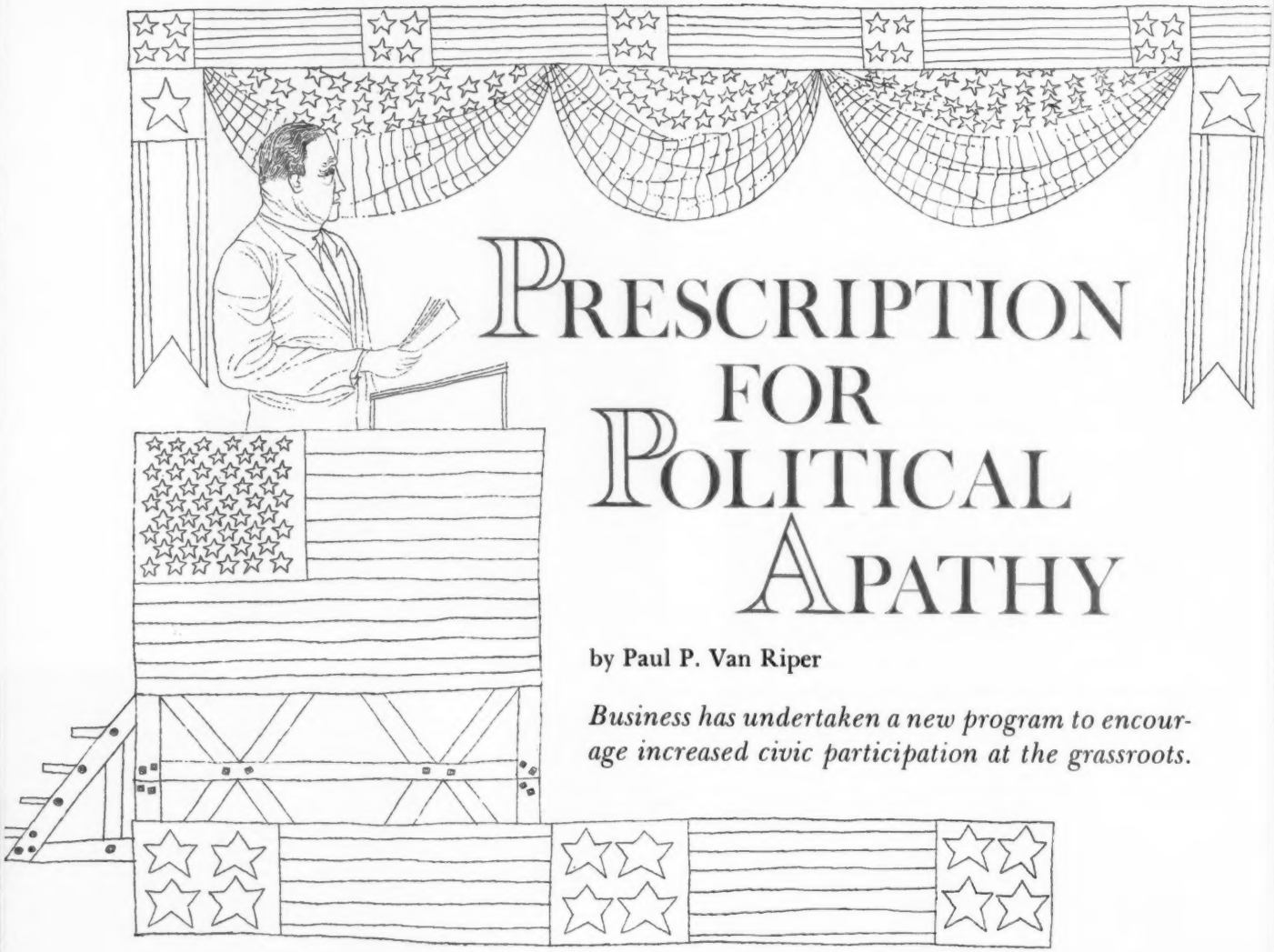


MILKING PARLOR *permits three cows to be milked simultaneously while Morris prepares three more on other side of parlor. Milk moves via pipeline into a 500-gallon refrigerated storage tank.*

TEST SAMPLE *is taken by Gus Williams, a neighbor and 34-year milk hauler. His tank-truck service costs less than old milk-can system.*

TRACTOR RIDE *is great fun for five-year-old Roger. But it's serious business for his father, who uses three for field work (at the rate of 1,500 gallons of gasoline a year).*

ON ITS WAY *to dairy goes two days' production, with the family there to wave goodby. Minutes later they are back at chores, the boys pitching in with their parents. Young Roger says that he already knows "everything about this farm."*



PRESCRIPTION FOR POLITICAL APATHY

by Paul P. Van Riper

Business has undertaken a new program to encourage increased civic participation at the grassroots.

MANY years ago my father told me, "The vote is your ticket to freedom!" Knowing his stern sense of duty, I was sure he meant it. I have since come to believe that my father's short phrase embodies the essence of that combination of freedom and responsibility that is the supreme value of American life.

To be sure, the authors of the Constitution were primarily concerned with our rights as citizens. After all, they had just fought a revolution against tyranny. But in their thirst for freedom, duties and responsibilities were neither forgotten nor neglected. They were simply assumed.

Indeed, for such men as Jefferson and Franklin, voting itself was always just the beginning. The philosopher Henry Thoreau told us a century ago: "Even voting for the right is *doing* nothing for it. It is only expressing to men feebly that it should prevail." A government of the people, by the people, and for the people takes more than just ballots; it also requires a great deal of "doing" on the part of every citizen. No one understood this responsibility better than the makers of our fundamental law.

Yet, even in the past 10 years, when the nation has faced an unprecedented series of crises, millions of Americans have been neither voting nor doing much of anything else about politics

Dr. Van Riper is a professor of public administration at Cornell University. He is a political scientist and the author of The Handbook of Practical Politics.

and civic affairs. We professors have coined a new and complicated term for this civic apathy—"political alienation."

Some of the symptoms have been easy to see. A single example will suffice. Between 1896 and 1948 the proportion of Americans voting skidded from a high of more than 80 percent to a low of near 50 percent.

At first, as might have been expected, we men blamed our women. (They replied indignantly that the decline started long before they won the vote in 1920.) We raged at the big city bosses or at the seductive combination of radio, television, autos, and leisure.

Then in 1948 Professor E. E. Schattschneider, of Wesleyan University, a former president of the American Political Science Association, pointed a finger at our colleges and universities: "I blush to say it, but the idea of nonpartisanship is perhaps the chief contribution of academic political scientists to American political folklore. The assumption is that people who do not take sides are morally superior to those who do, that unorganized voters are better than organized voters, that it is more moral to be fatuous than it is to be effective."

Political alienation as a phenomenon was not limited to any single group of our citizens but cut across every geographic and ethnic and vocational boundary, with the business community definitely not excepted. To be sure, many companies for years maintained lobbyists in the nation's capital, but their status was low in the corporate chain of command; management was little interested in politics on any level.

Both Presidents Truman and Eisenhower publicly noted the difficulty of finding top businessmen willing to serve in national political office. Nor were the city councils, boards of education, and precinct committees being served any better by those lower down on the corporate ladder. In Ohio one-third of the managerial and supervisory personnel were not casting a ballot. And 90 percent of the businessmen in another midwestern area had no idea how their Congressmen were voting on taxes, education, welfare, defense, or much of anything else.

Yet it is from this very sector of our society, from business and industry, that one of the most recent and most meaningful solutions to the problem of maintaining an enlightened, responsive, and responsible citizenry has come. This is the new "business-in-politics" movement.

The germ of the drive to bring business and everyone associated with it back to first political principles can be traced to the formation of the Effective Citizens Organization at Chicago in 1954. A group of young business leaders, then officers in the U. S. Junior Chamber of Commerce, were worried. They saw businessmen avoiding any personal connection with American politics at the very time when political problems were of the most crucial importance. The thread of contact between business and the political pulse of the nation seemed about to break.

So ECO was born. Since then it has been working with representatives of hundreds of companies in a nonpartisan effort to stimulate political action in "the party of your choice." The main technique has been absurdly simple. "It is time to go back to school for a bit," ECO said, "and learn about politics firsthand from those who have spent their lives in it. Then you try on your own." The result has been a long series of two-day "political workshops" held throughout the country. Hundreds of businessmen have been brought face to face—many for the first time—with Congressmen, State legislators, mayors, party leaders, civil servants, and even political science professors.

In 1958 both the National Association of Manufacturers and the U. S. Chamber of Commerce developed materials for "Action Courses in Practical Politics." Thousands of people from all levels of business and industry have attended these courses, which are practical, down-to-earth, and more question-and-answer than lecture.

At the same time many individual corporations were working out a new double-barreled approach to political action:

- Management began to reorient its public relations effort toward a more broadly based concept of "public affairs." The responsibility for political reporting and analysis was placed close to the president. A few firms even went so far as to appoint a vice president or director of public affairs and to put him on the top management team.
- More important in the long run, some firms embarked upon a general program of civic and political education for all their employees.

How does the business-in-politics movement work in practice? This was the experience of a Kansas oil worker, a roustabout-pumper.

"Before I attended one of our workshops," he said, "I didn't know the difference between a precinct chairman and a polling judge. We've got to know how politics works to get interested."

He and his wife had both just completed—on company time and at company expense—a recent

two-day workshop in practical politics at Lyons, Kansas. There he first learned about the firm's new program, in many respects a trailblazer.

He discovered that if he held an official political position (no matter how minor), he would be allowed time off with pay for election day activities and to attend any party conventions to which he might be a delegate. He found that he could get time off without pay to engage in other political activities that would not interfere with his work schedule. He was told of one employee of the company, a Wyoming State legislator, who has for some years been given a two-month leave of absence while the legislature is in session. These are among the most liberal policies of any business concern in the nation.

But the roustabout also learned a great deal about *how* to get into politics. His instructors for this phase of the workshop were members of a panel that included the Republican and Democratic county chairmen.

A second panel (this one made up of State legislators) gave him and his fellow "students"—about 75 at this particular workshop—information on how the Kansas Legislature is organized, the kind of correspondence legislators would like to get from constituents, and how a bill becomes a law. Everybody was free to ask questions and nearly all did. And there were regular 30-minute coffee breaks, during which he and the others attending could privately buttonhole the panelists and bring up personal questions.

The oil company that sponsored the Lyons workshop has, based upon its experience, developed its own workshop format, flexible and always tailored to the local area. This is a direct and beneficial result of the firm's decentralization of its public affairs effort.

Citizen votes: The combination of freedom and responsibility is "the supreme value of American life."

At the top is a small three-man office, created in February 1959 and reporting directly to top management. Some materials and suggestions are provided from this office, but the main effort is left to the discretion of regional general managers. These men appoint their own coordinators on the area level. One of the coordinators is a geologist; others come from such varied fields as law, marketing, and industrial relations.

Since July 1959, programs have been offered either on the company's initiative or at the request of groups of employees. That the latter have been rapidly increasing attests to the growing grassroots strength of the program.

No one is compelled to attend this company's workshops, and some do not. But by June of this year more than 1,200 of the approximately 10,000 employees had taken part, and so had 500 to 600 wives. July should see at least another 500 persons involved. "We will continue these programs as long as there is any demand," the manager of public affairs says.

All levels of the company have been represented at the workshops. Nearly all have had a cross section of employees, including both hourly rated workers and representatives from middle and upper management. Regional managers have reported an extra dividend from this kind of cross-level mixing in the form of improved communications and employee relations.

The popularity of the programs is evident. But what about concrete results in terms of their avowed aim, that of actual political participation?

These are hard to assess precisely, but the company provides this report of the southwestern regional manager as an example. He had conducted an informal telephone poll among participants in the eight workshops in his area.

"Approximately 500 employees and their wives attended precinct conventions following the election on May 14. A high percentage of these were attending their first precinct meetings. We have every indication that over 90 percent of those eligible voted in the primary election. Between 60 and 70 employees and their wives were delegates to county conventions; and at the present time we know of 14 employees from this region who are delegates to the Democratic State Convention, and at least three employees are delegates to the Republican State Convention."

These are astonishing figures, especially when one considers that prior to 1959 virtually no employee had been a convention delegate.

Five years ago a business concern that offered its employees time off and paid their expenses to attend a political workshop would have been laughed at. But this company tells its workers that it believes "that political awareness on the part of our employees is fully as important as the exploration for oil." And today there are many firms, in the oil industry and in the American business community at large, engaged in comparable efforts.

Precinct worker circulates petition: For men like Jefferson, "voting itself was always just the beginning."

Basically, these new political programs recognize a fundamental principle that had been almost forgotten. Raymond Moley, political economist and a leading supporter of the business-in-politics movement, has put it this way: "The real battleground is where lawmakers, not laws, are made." This is the grassroots approach, as opposed to the old "trickle down" theory. The new political workshops are aimed at stimulating individual political action. And they are either bipartisan or nonpartisan, factual and informative, seeking to lay bare the processes and problems of politics rather than to dictate any "party line" of the company.

But despite the evident success of such workshops as that at Lyons, and those of many other industrial concerns, by no means all of American industry has boarded the business-in-politics bandwagon. Some civic leaders have expressed a good many reservations about the motives and procedures involved. Senator Thruston B. Morton of Kentucky, a businessman, has warned: "If businessmen are to achieve a maximum effectiveness in politics, they must work toward this goal as citizens rather than as spokesmen for, or representatives of, just one segment of our national economy." Others have flatly stated that the proper business of business is business, not politics, however worthy the objectives may seem.

And these critics do have a point.

Before embarking on a business-in-politics program, a company should take a long, hard look at its own conscience. Politics is a double-edged sword. Is management prepared to have its employees publicly differ from it on matters of major, or minor, political import?

I am not so concerned about an employee—an avowed Marxist, for example—whose political objectives would be clearly incompatible with the continued existence of his or any other company. Like other elements of society, corporations are entitled to fight for their lives. But I am concerned about an employee who might advocate political policies that are a matter of legitimate difference of opinion within a democracy, in such explosive problem areas as civil rights, fair employment practices, union-management relations, housing, education, control of natural resources, government regulation of business, taxation, awarding of government contracts, assessments of property, and the like.

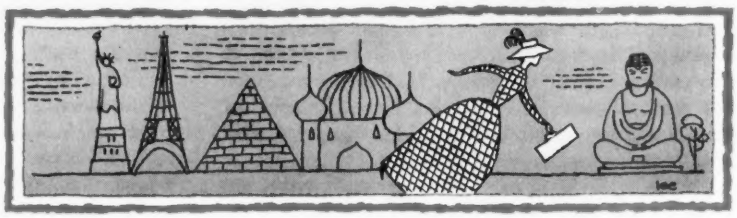
Assuming that a company faces this question and makes the right—and the only sensible—decision, it is essential that it then obtain expert advice in the formulation of its detailed policies. The political, personnel, and legal problems involved are many and complicated, and this is no place for the amateur. And once the policies are carefully determined, they should be explained so thoroughly to all concerned that there can be no misunderstanding. This would apply to the community at large as well as to the employees.

Finally, I have a challenge.

Will American industry have the political savvy and guts—for it will take a great deal of both—to face the fact that freedom is indivisible?

If our corporations and business concerns do what they can to support in American politics what Justice Oliver Wendell Holmes years ago called "the free marketplace of ideas" to as great a degree as they uphold free enterprise in economic affairs, both business and our nation are likely to prosper.

This is the ultimate test of the business-in-politics movement. In the response of business and industry to this challenge will be found the ultimate meaning of the workshop at Lyons.



Nellie rolled out the barrel

by Tom Allen

AS NELLIE BLY, the intrepid girl reporter who traveled around the world in 72 days, she is only a nostalgic tintype on the pages of American history. She stands there, hazy and old-fashioned in her plaid ulster, remembered only for a grand and glorious stunt.

As Elizabeth Cochrane Seaman, she is almost completely unknown. Yet, in this nearly anonymous role, she helped lay a magic carpet for the American petroleum industry, launching oil on a global journey that has never stopped.

Nellie Bly was created by Joseph Pulitzer, publisher of the New York *World*. Under Pulitzer's tutelage, Elizabeth Cochrane, a wide-eyed girl barely out of her teens, became Nellie Bly—a byline both feared and famed. Nellie feigned insanity to expose the conditions in an insane asylum. She made matronly readers tremble with her accounts of the mashers who prowled New York streets.

But all this was a mere apprenticeship for the greatest assignment of her career, and one of the greatest newspaper assignments of all time. In a day when young ladies rarely traveled on the streetcar alone, Nellie was to race around the earth in an attempt to beat the record of Phileas Fogg, hero of Jules Verne's *Around the World in Eighty Days*.

Nellie, then 22, stepped aboard the Atlantic steamer *Augusta Victoria* on November 14, 1889. She wore a high-buttoned ulster, a pert traveling cap, and sensible shoes. She carried a small bag, a silk raincoat, and a black satchel that contained, as the *World* breathlessly reported, three veils, an extra dress, a dressing gown, needles and thread, writing instruments, a (water) flask and drinking cup, a modestly unspecified amount of underwear, and a makeup kit consisting of a jar of cold cream.

She was off! By steamer, train, ricksha, horse, sampan, and burro, she raced across oceans and continents, enduring monsoons, seasickness, and the mutterings of superstitious sailors who demanded that she jettison a pet monkey she had acquired in Singapore. (Nellie refused.)

She did the last lap aboard a special transcontinental train Pulitzer had dispatched to California. Her record time: "72 days, 6 hours, 11 minutes and 14 seconds."

When the cheers died down, it must have suddenly dawned on Nellie that she had reached a peak she could never scale again. For a few years she basked in a fading fame, but her life as Nellie Bly was over. By 1895 she was only Elizabeth Cochrane again, a 28-year-old woman looking for security. She found it in Robert L. Seaman, a 72-year-old Brooklyn industrialist. Seaman was president of the Ironclad Company, a prosperous business seemingly as formidable as the famous warship *Monitor*, which was its trademark.

Elizabeth Cochrane Seaman became a *grande dame* of New York society—and a year after her marriage, the legal owner of Ironclad, which was presented to her by Seaman as a practical, though patently unromantic, gift.

For most of the four years that followed, Elizabeth and her aging husband traveled abroad, and Ironclad clanked along without them, turning out an endless procession of ashcans, teakettles,

dishpans—even the kitchen sink.

Then, in 1899, she went to work as the boss of Ironclad, and it was as if Nellie Bly had been born again, amid the factory's prosaic hardware. Even as she took the helm, Ironclad was sinking under a $300,000 tidal wave of debts. Nellie worked 11-hour days to save her business, and once more Nellie Bly was a winner against the odds. As she boasted of her victory years later: "I quadrupled the business of Ironclad within five years. . . . "

In 1904, just as Nellie was pulling Ironclad off the shoals, Seaman died. With her husband dead and her business saved, there was nothing holding Nellie to her cluttered factory office. She left on a tour of Europe, hoping, perhaps, to live again her great adventure. But it was a different Nellie traveling about the Continent now. She was no longer a tourist. She was a businesswoman, with an eye for new ideas, not old monuments.

When she got back to Brooklyn, she started producing something she had seen being developed in Europe: steel barrels.

Nellie's mass-produced barrels had an immediate market, most particularly in the oil industry. The industrial revolution was sweeping across the civilized world, and petroleum was providing the power. But the costly, leaky wooden barrels used to transport oil were a major stumbling block in the way of a reliable distribution system.

Oil companies themselves were tinkering with steel barrels when Nellie appeared with what they had been looking for. She called it a "barrel that defies comment."

"I worked night and day on that steel barrel," she said. "The first one leaked, the second one was not joined satisfactorily, the third barrel showed a tendency to discolor the liquids that were put into it. But I persevered."

Her perseverance won out. She founded the American Steel Barrel Company and began production. At first, only five barrels a day rolled from her plant. Soon, though, she was producing thousands of barrels and sales totaled $1 million a year. Nellie was the whole executive staff—sales manager, production supervisor, marketing chief. She was not, however, the auditor.

"Orders kept coming in from all parts of the country," she was to say one day. "Some divisions of the factory were running day and night, and all divisions were working on full time, yet there was never any money in the bank. I kept asking, 'Why?' 'Why?' . . . I then ordered an investigation and gradually the whole state of affairs was revealed. . . .

"I learned to my astonishment that I was charged with the purchase of a $25,000 yacht and a contribution of $15,000 toward a campaign fund. . . ."

The investigation disclosed that two employees, by forging Nellie's name to countless checks, had been robbing the company for years. The losses totaled $2 million, and Nellie lost Ironclad in a bitter and complicated bankruptcy fight.

She then became entangled in a complex of legal wranglings that went on for six years, her antagonists including the U.S. Government and her mother. By 1920 she had won a measure of victory, but the American Steel Barrel Company now existed largely on paper. The sprawling plant that had produced so many barrels and so much bitterness was now only a hulk full of wretched memories.

Steel barrels were rolling out of other plants, though. They played a key role in carrying low-cost petroleum energy to fuel the world's cars and planes and ships, to lubricate its industry. They met the challenge of rugged combat conditions in two world wars. Today the steel barrel is a thriving part of the giant metal-can industry, which is marking its 150th anniversary this year, and metal barrels are being manufactured at the rate of 34 million annually.

But the public did not remember Nellie's pioneer barrels and their historic importance. "They are my own invention!" she once plaintively cried.

Financially destitute after her long court battles and pathetically unaware that time had passed her by, Nellie tried once more to recapture her fame as a reporter. Her byline appeared again in the New York *Evening Journal,* but it was a pale replica of the name that had been emblazoned around the world so many years before.

On January 20, 1922, Nellie Bly died, leaving behind an ironic legacy: a newspaper stunt that is well remembered and a contribution to economic progress that is all but forgotten.

A shipment of oil products leaves an East Coast refinery for barge journey to market.

American GI's unload barrels of petroleum on Guadalcanal during World War II.

In the Virgin Islands empty oil barrels produce music in the hands of parading "steel bands."

THE FARMER AND THE CROWS

by Gardner Soule

ONCE upon a time there was a farmer, up in New York State, who told his wife: "I don't know what I'm going to do about those crows." The local flock was picking on him. And also on his corn. They were so unfrightened of his scarecrow that they sometimes posted their guard on the top of his straw hat.

Then one day the wife jokingly said: "What you need is a scarecrow that moves. That would fix the little black-guards." But the farmer did not think that it was a joke. He bought a little engine and hitched it to the scarecrow with wires and pulleys. And the scarecrow did move! And the birds never bothered the farmer ever again.

* * * * * * * * *

The fable of the New York farmer differs from other fables in that it has its basis in fact. For the mechanical scarecrow is not untypical of the uses, zany as well as practical, to which the little gasoline engine has been put.

Last year more than 6 million engines of 10.9 horsepower or less were manufactured in this country, and better than half of them were three horsepower and under. They are cutting a wide swath, not only in your front yard as the power plant for your lawn mower, but in a thousand and one business and personal applications.

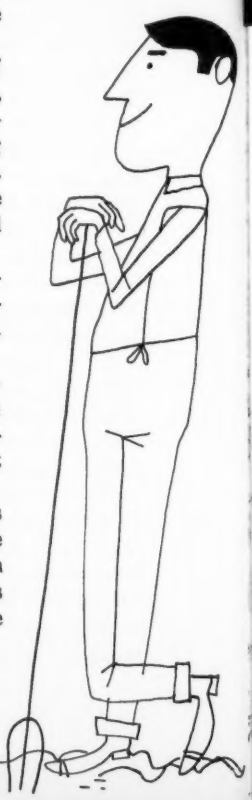
If you've ever pushed a wheelbarrow, you know that the barrow lacks something. Now it's been added, the first improvement in the wheelbarrow in 4,000 years—a seven-horsepower gasoline motor. All you have to do is watch and steer; no more lifting and pushing. You'll see the new version especially on big construction jobs. The favorite route is from heavy truck to building site.

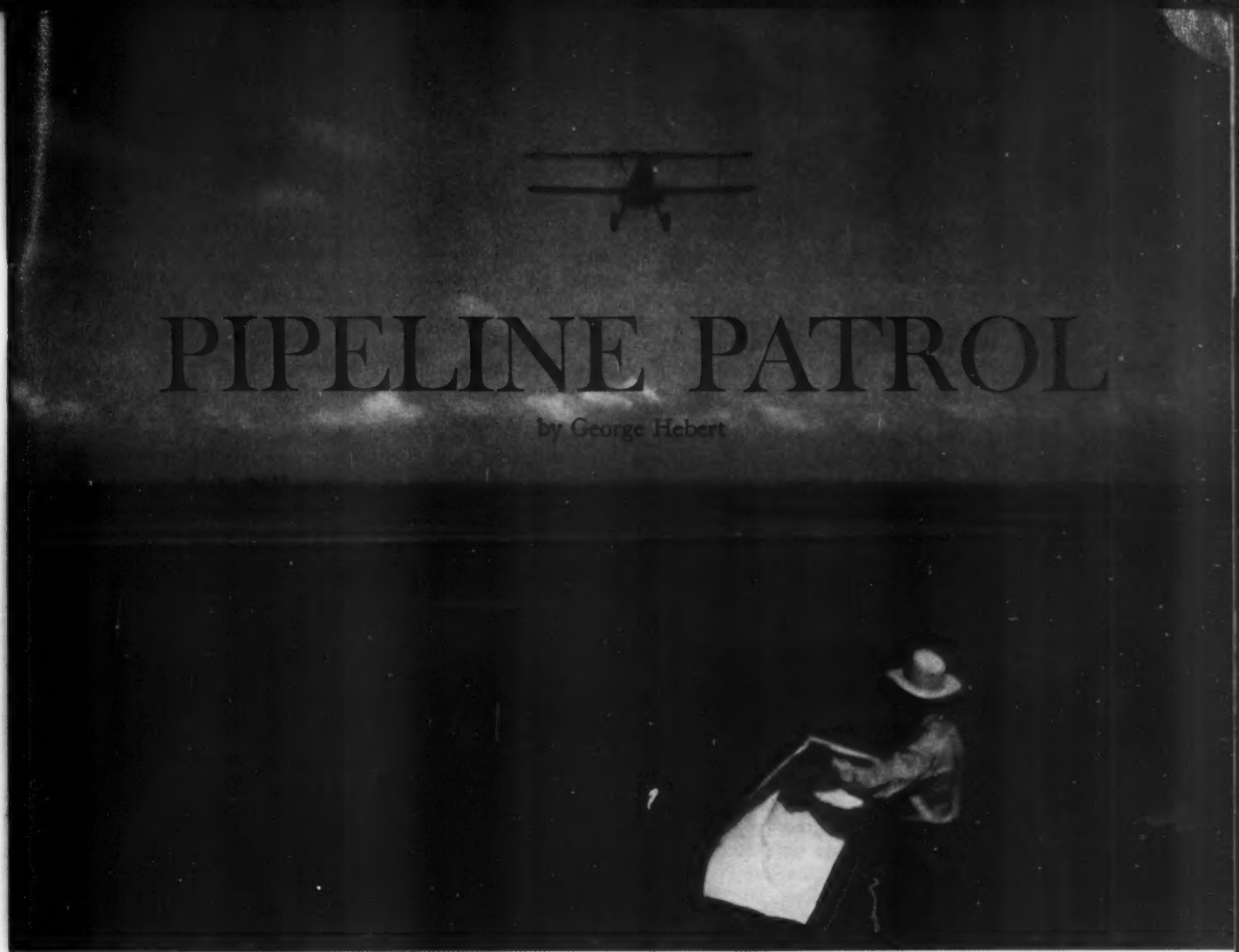
The familiar power lawn mower has bred a host of attachments that sweep up cuttings, leaves, and twigs, and shovel snow. It comes in all sizes and varieties, including one that operates like a car, aimed at appeasing (maybe) the son too young (or lazy) to push a mower. There were 100,000 power mowers made in 1946; more than 4 million last year. By 1965 the number is expected to reach 7.3 million.

Gasoline-powered auxiliary generators, one horsepower and up, are finding a ready market among homeowners for that moment when the electric power fails. Their fuel is as close as the corner service station.

Farmers are using the little engines to grind compost, detassel corn, dig trenches, cool milk, and grade potatoes. Deep sea fishermen use them to lift nets. Military men use them to power radio-controlled target drones.

Aside from the motorized wheelbarrow, the engines have found a special home in the construction field where they mix plaster, bend pipe, sharpen saws. And it is in this area that the wee motors have made what is perhaps their ultimate contribution. Now they're using little engines to get big engines started!





PIPELINE PATROL

by George Hebert

DURING World War II, Captain William A. Rose flew 46 missions over North Africa and the Mediterranean, getting "shot at but never shot up." Between flights, he pondered how he'd make a living in the "calm and quiet" of civilian life after the war.

Today, Bill Rose recalls his Air Corps musings with a wry grin. "I've made a living, all right," he says. "But it hasn't been exactly what I expected."

Rose is president and general manager of Louisiana Flyers, Inc., and one of the nation's most experienced low-altitude pilots—literally a hedgehopper. The 16 planes operating out of his Lake Charles, Louisiana, hangar spend most of their air time at altitudes between three and 300 feet. And Rose and his seven pilots work hard at turning a nerve-racking, hazardous job into "a matter of routine."

Major customers for the Flyers' specialized services are oil companies and farmers. For oilmen, Rose and Company patrol pipelines, watching for leakage and for potential hazards to pipeline operation. For farmers, they spray insecticides, drop fertilizer and seed. In both cases, their skill and equipment have made possible increased efficiency and economy.

Patrolling natural gas and oil pipelines is usually done at about 300 feet unless the patrol pilot spots trouble and drops to the deck for a closer look. Spraying a rice crop in the south Louisiana lowlands requires a pilot to come in over the field at a three-foot altitude to contain the insecticides and herbicides to a small area

and not poison a farmer's water trough or kill vegetables in his truck garden. He can fly at the more comfortable altitude of 20 feet when dropping the heavier fertilizer and seed.

There are some exceptions, though. "Every now and then," says Rose, "we have to come down over a pasture cow-high to a pipeline. And sometimes, spraying a rice field, we have to go up to five or six feet to clear a levee or a fence."

Rose's matter-of-fact comments about his potentially dangerous business typify his and his pilots' attitude toward their work. Flying out of their Lake Charles base, they rack up some 5,000 hours each year while executing the trickiest maneuvers connected with commercial flying.

Pipeline patrols are made by a pilot who acts as his own observer. Across the nation, some 80,000 pipeline miles are covered from the air. Most people assume such patrols are made especially to look for oil leaks. Actually, the majority of major oil leaks show up on instruments back in oil company headquarters in the form of a sudden drop in the pressure that pushes oil through the pipeline.

According to Charley Green, a Flyer these past 11 years and a regular patroller, most of the patrol pilot's activities are concerned with spotting potential hazards to pipeline operations, especially in areas where the line is not exposed.

"I look out for draglines, tractors, and other construction equipment working toward a point which would endanger a line. Washouts are a big problem in this bayou country. And I have to keep an eye out for dredges working close to underwater crossings."

Naturally, while Charley is flying low enough to observe any potential hazards, he is at the same time "routinely" dodging trees, tall structures, flights of birds, and other surprise threats while keeping his third eye on the instrument panel.

Green is one of four full-time and three part-time pilots working in Louisiana Flyers aircraft. During the 15-year history of their company, there has not been one serious injury.

Bill Rose says of his hiring procedure: "Hot pilots we use. In our business they've got to be hot. We don't hire heroes. We've found we can't afford them. I've worked like the devil to get farmers and local industry interested in our services. Now they're buying and there isn't any percentage in giving them the impression we're liable to scatter an airplane and its driver all to hell and gone over the back 40 every time we make a pass."

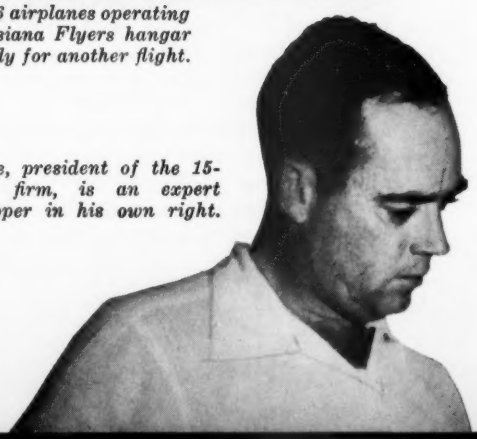
The element of risk is there, but skilled pilots flying the best of equipment who are out to fatten profits for their 25 percent cut aren't apt to caper just for kicks. Rose's pilots average $9,000 a year.

Bill Rose came to Lake Charles in 1945 with his military flying experience but without so much as a private pilot's license. He remedied this situation, formed a small corporation, purchased a second-hand Boeing-Stearman, and started a skimpy pipeline patrol and student flying service. Book balances struck at the end of the first year showed mostly red ink.

"Obviously," says Rose, "something had to be done or I had to start a fruit stand. Flying service operators in other sections of the country were doing pretty well in agricultural work, but in our part of the world the major crop, rice, was still a 100 percent ground-level operation. So we decided to pioneer the Louisiana Rice Belt. We modified our aircraft, bought a couple of others, and started knocking on farmhouse doors."

At first Rose was given a lot of syrupy Cajun coffee but few assignments. Then when word got around that one pilot, one plane, one truck, and one truck driver could plant up to 600 acres of rice in one day's flying time under almost any kind of atmospheric condition (they need only a 200-foot ceiling), the Louisiana Flyers hangar

One of the 16 airplanes operating out of Louisiana Flyers hangar is made ready for another flight.



Bill Rose, president of the 15-year-old firm, is an expert hedgehopper in his own right.

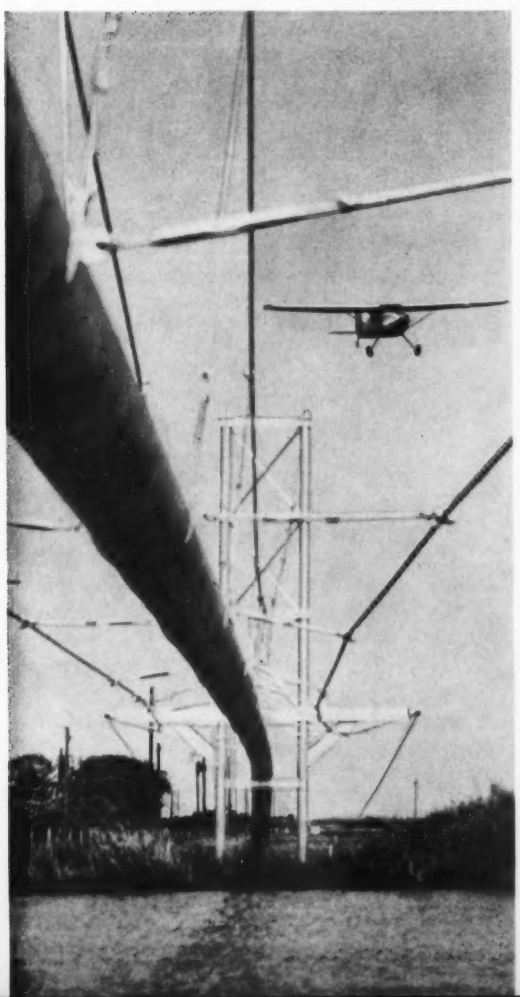
was empty of planes more often than it was full.

"Next we really went after the patrol work," Bill Rose says. "Working the rice crops is done during a hectic four-month period. A successful operator needs the bread-and-butter pipeline and powerline patrol work to fill in the gaps."

The oil industry was easier to convince. An energetic, on-foot pipeline patrol could cover about 100 miles in a 40-hour week along rights-of-way that offered firm footing. A pilot, working just seven hours a week, could fly 700 miles of line whether it crossed a dusty prairie or served as a sun deck for cottonmouths across the wild reaches of bottomless Louisiana swamps.

Equally important are a 15-year accumulation of log sheets that prove that pipeline patrols are made on a regular schedule. Louisiana Flyers last year completed 98 percent of their patrols on a strict timetable basis and the other 2 percent not more than a few hours late—this in spite of the unpredictable and often inclement Louisiana weather.

Patrol plane, skimming low over pipeline crossing, guards flow of petroleum energy. The pilot keeps his eyes peeled for washouts and other potential hazards.



It's vital that the pipelines get regular checking, since they are, in effect, lifelines of the nation's industry. Failure to spot potential trouble could interrupt the flow of energy and could cancel out the efficiency of a transport system geared to keep costs, and thereby consumer prices, at low levels.

The pilots operate under a constant tension, meeting deadlines, facing crises. And they have their own ways of easing up. One is poker, played for low stakes but at a furious pace, between flights. Another is kidding the boss. Bill Rose is no swivel-chair president; and when a call comes and his pilots are out, he doesn't hesitate to take over the assignment himself. "Damned if he doesn't get the best ones," a pilot will say, sitting across from Rose, shaking his head in mock anger. But after the shouting is over and the boss has gone, the same man will shake his head in admiration. "He's all right, that guy."

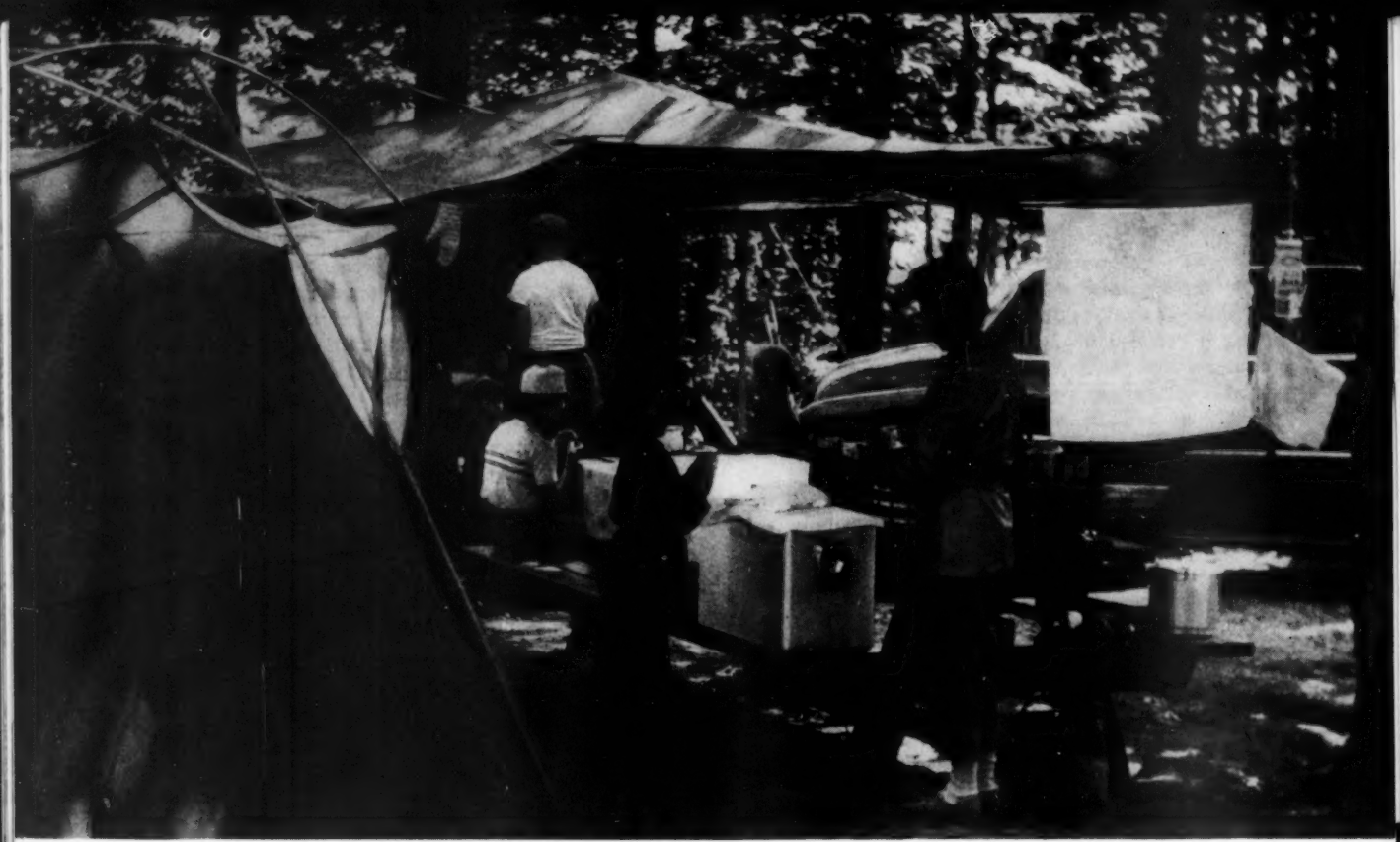
During the rice season, the only thing that keeps the planes on the ground is darkness. That's when the maintenance crews take over.

Coming in from a 14-hour day in the open cockpit of a Stearman, a pilot sunburned the color of an old flying boot and just as dirty, lugging his sweaty seat cushion, will greet Bill Rose with a laconic, "The airplane don't work right." Rose pins down the complaint and passes it along to the shop crews. They make the necessary repairs.

Although Rose follows to the letter all applicable Federal Air Regulations, he has his own code of maintenance and upkeep that exceeds those required by law. And his customers know it.

Rose operates a busy charter and ambulance service in addition to other flying chores, and he just recently became the only flying service operator to develop a new type of dispersal equipment that permits successful pine tree seeding from the air. Reforestation managers realize a saving of $10 per acre from Super-Cub drops of pine seed treated with bird and rodent repellant.

New techniques and old-fashioned persistence have enabled Bill Rose to build a thriving business. And he's proud of the role his planes have played in helping streamline farm and pipeline operations. But sometimes he wonders just whatever did happen to the "calm and quiet" of civilian life.



"A camping neighbor came visiting just in time for lunch during our stay in Franconia Notch, New Hampshire. Wife Rita did the honors. The tents and other equipment you see were picked to fit into the family chariot."

FATHER

"One of the wonderful friends we made on the trip wanted a photo of his daughter. And there I was in the background, posing for a cigarette ad."

"Our trips give the kids a rare chance to explore nature. Jeff didn't lose his usual serious expression, but he couldn't have been prouder of that fish. Allyn, his fastidious sister, had mixed emotions about the first frog she ever handled."

"Rita couldn't resist intruding the camera into the start of this private father-son voyage. Jeff and I got to know each other a little better."

IT was our first camping trip. For three days the rain had come down in torrents. Our campsite in the Adirondack Mountains was a sea of mud, and there wasn't a dry stitch of clothing among the five of us (my wife Rita and me and our children, Jeff, Allyn, and Elise). At one point toward the end of the third day I came into the tent with the water rolling off me. Rita, who detested the idea of camping, took one look and favored me with a long, low laugh. "Having fun, Nature Boy?" she inquired.

That was three years ago, and we've gone camping every vacation since, with many a long weekend thrown in for good measure. Rita looks forward to each new trip with mixed emotions; but I notice that after we've returned home, she never stops talking about the natural beauties we've explored or the wonderful people we've met. The kids couldn't be more enthusiastic. And as the one who started it all, I accept (and in family councils demand) full credit for an idea that has brought us real satisfaction.

The trip illustrated in the accompanying photographs covered about 2,700 miles over a three-week period and set me back about $300. This covered food, souvenirs, a one-night stopover at a tourist home, and gasoline and oil for the car and outboard motor. Not included was a pretrip check-up for the family car—a precaution we learned about the hard way when our auto broke down in Canada on an earlier trip. The courtesy of a service station attendant couldn't make up for the precious time lost.

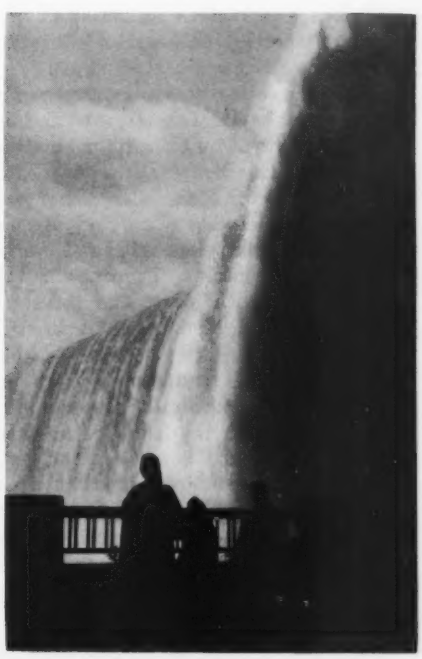
Proper planning is not only necessary but fun as well. Ri and I start talking about where to go next time within a week of our return from a trip. Then when the time comes, we just haul out the equipment we've gathered over the years, tuck in the kids, and tool out the driveway—Nature Boy at the wheel.

Text and Photos by Hal Power

KNOWS BEST

"We were leaving Lake George the next morning and invited our neighbors to an early evening of song, popcorn, and crackling fire. Just seeing the photo brings it all back."

"Along the way the kids (and their parents) visited tourist spots like Adventure Town, where our pixie Elise tried on a hangman's noose for size."



"The trip opened our minds as well as our eyes. On the Canadian side at Niagara Falls Allyn commented, 'The people here talk funny.' I suggested to her, 'Up here, we talk funny.' I'm sure she got the point."

Microbes Are Two-Faced

by Ernst Behrendt

A VISITOR to the new oil refinery near the shores of Lake Ontario is conducted on a tour of elaborate automatic equipment, huge furnaces, and gleaming steel towers.

Then, toward the end of the tour, the guide opens a door with a flourish. The visitor finds himself staring at a number of fish staring back at him through the plate glass window of an aquarium. "The process in this part of our plant," says the guide, "is a billion years old."

The aquarium is there because of a problem common to industrial operations—waste materials. The process involved features a voracious animal that plays a most ambiguous role in the annals of the petroleum industry: the microbe.

Until recent years microbes have been villains plain and simple. The largest of them measures about 1/250th of an inch; but no matter how small, they are alive. Being alive, they eat. And their menu includes million-dollar dishes.

The refinery aquarium demonstrates the "new look" in microbes. Industrial waste from the refining process contains chemicals known as phenol compounds, which give water the smell and taste of carbolic acid. Yet the water used in the plant must be returned to the lake. By subjecting the waste materials to a session with phenol-eating microbes, the chemicals are removed. The water is then put back in the lake cleaner than it was in its original state.

Water is fed directly to the aquarium from the microbial settling pond; thus the thriving fish provide the refinery with proof of the efficiency of the process. They couldn't exist in the presence of phenol compounds.

Such beneficial uses of the mighty microbe have not been developed overnight. Scientists have conducted, and are conducting, research aimed at reforming the animal. But any balanced discussion of the microbe must first treat of him as an enemy; the oilman's attitude toward him, on the whole, is decidedly unfriendly, and with good reason.

Take the case of the oil company that some time ago started drilling a hole in southern Texas. Its geologists were optimistic. At a depth of about 8,000 feet the drill reached what everybody had hoped would be oil sands.

Many hundreds of feet and many thousands of dollars later the company knew that the hole was as dry as a dirt road in August. Yet the geologists were certain that this was not an ordinary (and all too common) duster. "At one time oil must have been here," they said. No one could prove conclusively that microbes were guilty, but the circumstantial evidence was strong against them.

First, it has been shown that microbes can live in rocks thousands of feet below the surface. Second, when a certain breed of microbe is put in a glass jar and several drops of oil are added, the microbes will still be there a few days later; but some or most of the oil will be gone. The microbes will have managed to break it down and eat it.

Now let's suppose that the microbes haven't had time yet to destroy an underground oil deposit or that they never reached it. The oil reserves are intact. Let's further suppose that an oilman has successfully completed his well and that the oil is flowing.

If conditions are right, some groups of mi-

crobes will attack any iron or steel with which they come in contact—the casing, the pump, everything. How they do that is a complicated story, but the gist of it is that microbes often manage to spot a tiny bit of rust that they then use as an entrance gate to get under the surface of the metal. But wherever they go, rust follows them. They need rust, rust needs the environment they create, and the unholy combination of a mere speck of rust and a greedy horde of microbes may ultimately wreck the well machinery.

Oilmen fight corrosion with rust inhibitors and with germicides, some of which do the job very well. They have to be careful, though, for there are microbes that like rust inhibitors, too.

The microbes may leave the tools alone, but they are by no means through with the oil yet.

Oil flows through pores in underground sands into the well. But once certain types of microbes get into the sand—they usually get there with water—the situation can rapidly become critical. The microbes may multiply so fast that within a short time billions of them will be roosting in and around the pores. Their tiny bodies and the substances they form—slime, for instance—then seal the pores and stop the flow of oil. Or they achieve the same result by applied chemistry. First, they produce immense quantities of hydrogen sulfide. This substance reacts with the iron in the water and forms iron sulfide, which is insoluble and which also clogs the pores.

To anybody but an oilman the fact

Drilling for oil is a tough and demanding job. Microbes complicate the process by attacking metal equipment, drilling "mud," and the petroleum itself.

that microbes like mud must seem a matter of supreme insignificance. But consider the case of the wildcatter in Oklahoma who probably did not know quite enough about microbes. As "mud," i.e., drilling fluid, he used one of the standard mixtures of clay and water. Starch was added so that the water and mud would stay mixed.

For some reason, drilling operations had to be stopped for a few days. After they were resumed, they came to a rapid halt again when engineers discovered that the entire mud supply had been lost. Microbes had attacked the starch. The starch had been dissolved; and the water had filtered through the side of the well hole, leaving a residue of solid glop.

Even when the oil has been brought to the surface, microbes continue their pesky habits.

For example, a steel pipe may appear solid enough. On the outside it may look as good as new. But take a knife to the pipe. You'll be amazed to find that the blade slices through a six-inch line as if it were a piece of cheese—if the microbes have had a chance to work on the pipe for any length of time. Oil engineers see to it that they don't have such chances, but it's a full-time job.

It would be a relief to say that the microbes' attack does not extend beyond the pipelines. But it does. The next battle may be fought in a storage tank or in an oil tanker. Again, it's the now-familiar tale of microbes invading metal and boring from within.

And beyond land and sea, microbes have taken to the air in their pursuit of the oilman. According to a recent report in a Government publication, they have been found in jet aviation fuel—clogging filters and strainers. Of course, it would seem a simple matter to kill them with some chemi-

The water inside this aquarium has been used to carry off refinery waste materials —and has been brought to its present pure state by specially trained microbes.

This farmer is an oilman. He works on an oil company experimental farm where petroleum-based pesticides are developed and tested. His immediate chore is the raising of plant lice—the better to kill them. But his long-range goal is the same as any farmer's: better crops.

AND THEN THERE WERE NONE

Scientists in the microbe field have grown accustomed to the bizarre:

A factory near the banks of a major East Coast river was engaged in electroplating work. River water taken in at one end of the plant was used to float waste materials out the other end. Microbes caused the bits of copper and silver to sink to the bottom of a settling basin, and the cleansed water was returned to the river.

Then one day government authorities complained: bits of copper and silver were turning up in the river. Factory engineers found that the microbes had disappeared. All was confusion until someone remembered that a new factory had been built upstream from the plant. The new factory's product (and a major component in *its* waste material) was penicillin!

cal additive, but then a new problem arises: The chemical may alter the fuel's performance.

No wonder the oilman's attitude toward the microbe is decidedly unfriendly. But there have been developments that may cause him to change his mind—at least to a degree.

One of the greatest hopes for the rehabilitation of the little animals seems to lie in the fact that microbes can be trained. Before they are permitted to tackle phenols in refinery liquids, for example, they are placed on a strict diet. Each day they are fed larger and larger amounts of phenol compounds until they become interested in nothing else, particularly those chemicals that should not be disturbed. Microbes that cannot take the pure phenol diet fall by the wayside. The others eat exactly what they have been told to eat.

Microbe training can go beyond diet. Scientists are seeking to breed them, to weed out weaker strains and replace them with vigorous varieties. Some microbes are being exposed to atomic radiation in the hope that the new mutants will be tough enough to undertake special chores.

What kind of chores? Well, there are research men who believe that microbes may some day help the industry find oil and bring it up from the ground. At this point, such beliefs are little more than hopeful theories, but they're fascinating.

A few years ago a Louisiana scientist started taking soil samples from shallow holes in the ground. His idea was that since some microbes thrive on hydrocarbons (such as methane, propane, ethane), the presence of these microbes would indicate underground oil deposits from which the gases had leaked to the surface.

He did find conspicuous clusters of microbes around gas leaks too small to be detected by chemical means. In theory, an oilman could now try to find oil merely by following the microbes; this would be like following bees to find flowers.

A California scientist has been given a U. S. patent for an "improved process for facilitating the recovery of valuable fluids from fluid-bearing earth formations." The process: injection of microbes into oil-bearing limestone formations. The theory: Some microbes secrete acids; the acids eat holes in limestone; the limestone becomes more porous, making for wider channels through which the oil can flow.

This researcher also claims that in the process of eating into the rock and dissolving it, microbes form carbon dioxide. This increases the internal gas pressure, he believes, and again speeds up the flow.

In the U. S. Bureau of Mines scientists are seeking to breed a microbe that might help extract the oil from this nation's huge shale deposits. Shale-eating microbes do exist. In laboratories they have shown a healthy appetite for the rock and have left the oil untouched.

In addition to these microbial theories in the workaday world of petroleum, there is a school of thought that believes that microbes played a key role in the creation of oil. (The more conventional explanation has it that petroleum was formed out of animal and vegetable matter subjected to tremendous underground pressure and heat.)

Yet there are microbes that seem to know how to make oil. The lipolytic ("fat-solving") type produces a substance very much like oil if it gets enough dead algae to eat. The so-called sulfate-reducing group performs a similar trick.

Sounds good, but oil people aren't counting on microbes to produce the millions of barrels of petroleum the nation requires. Nor are they looking forward to any sudden microbe-inspired improvement in the odds against finding oil. Considering the history of microbes in the industry, the men in the field are understandably wary of the hungry little animals. Sort of a case of once bit, twice shy.

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